Strål säkerhets myndigheten
Swedish Radiation Safety Authority

Authors: Johannes Hummerdal
Nicklas Dahlström
Sidney Dekker

Research

2012:66

Safety Leadership – the managerial art of balancing production pressure and safety

Report number: 2012:66 ISSN: 2000-0456
Available at www.stralsakerhetsmyndigheten.se

SSM perspective

Background

Within the area of safety management and safety culture, management functions and the management's capability to implement effective management to promote safety are crucial components of all safety-critical industries, not least in the nuclear industry.

A few years ago, the regulator identified a need for a better understanding and more in-depth knowledge of safety leadership in general and how it is manifested in day-to-day work. Safety leadership is considered critical for the capability of an organization to deal with conflicting demands of safety and production. Ideally, safety leadership monitors its own practices and decision processes in order to detect when it might be allowing the organization to drift towards safety boundaries, but this is a very difficult task. Daily demands placed on production, efficiency and resource utilization can overshadow the safety leadership's concerns when it comes to safety. This can result in the safety management becoming uncoordinated and fragmented across lower organizational levels, where breakdowns at the boundaries of organizational units, professional roles and hierarchical levels can hamper effective communication.

Objectives

The objectives of this study were to:

- *operationalize the concept of 'safety leadership':*
  Through a discourse analysis, strive to define what relevant actors in the nuclear industry, and other industries, mean by 'safety leadership', identify what appear to be the central themes in safety leadership from the point of view of the relevant actors, and to examine how they measure up to the research base on resilience engineering.

- *survey preliminary assessment dimensions:*
  Build on the work of resilience engineering and further develop relevant aspects with which to compare and contrast safety leadership in different settings.

- *identify contrast cases:*
  Carefully select contrast cases for their potential content so that the setting against which nuclear practices are compared for closer scrutiny is both sufficiently similar and critically contrasting to generate potentially interesting insights.

Results

A substantial part of the project has been dedicated to investigating and characterizing 'safety leadership', set in the context of literature on safety leadership, safety culture and safety management, in order to build a solid theoretical basis. The authors have delved deeply into the theories and conceptualizations of leadership and analysed this area in order to further the understanding of safety leadership in the light of resilience applications.

The study proposes a constructivist approach to safety leadership and its effectiveness and suggests four assessment dimensions: identity, story, strategy and persuasion. Examples from the Swedish nuclear industry were used to illustrate organizational performance and exemplify resilient properties. Two contrast cases were selected: healthcare and aviation; both adding value to the understanding of leadership and the important differences emphasized between reliability and resilience.

Need for further research

The regulator recognises the need for further exploration of the methodology and the need to implement leadership assessments in safety-critical industry.

Project information

Contact person SSM: Lars Axelsson
Reference: SSM2011-1093 and SKI 2006/868/200603007

Strål
säkerhets
myndigheten
Swedish Radiation Safety Authority

Authors: Johannes Hummerdal, Nicklas Dahlström and Sidney Dekker
Lund University School of Aviation, Department of Science and Research

2012:66

Safety Leadership – the managerial art of balancing production pressure and safety

Date: October 2012
Report number: 2012:66 **ISSN:** 2000-0456
Available at www.stralsakerhetsmyndigheten.se

This report concerns a study which has been conducted for the Swedish Radiation Safety Authority, SSM. The conclusions and viewpoints presented in the report are those of the author/authors and do not necessarily coincide with those of the SSM.

SSM 2012:66

Table of Contents

SUMMARY **3**

SAMMANFATTNING **5**

1. UNDERSTANDING SAFETY LEADERSHIP **7**

2. LEADERSHIP FOR RESILIENCE **9**

2.1. LEADERSHIP – BALANCING SAFETY AND PRODUCTION PRESSURES 11
2.2. APPLICATIONS OF RESILIENCE TO THE REGULATOR 12

3. SAFETY LEADERSHIP – DECONSTRUCTING THE RESEARCH BASE **22**

3.1. DEEP LEADERSHIP 24
3.2. ASSESSMENT DIMENSIONS 25
3.2.1. Identity *25*
3.2.2. Story *28*
3.2.3. Strategy *29*
3.2.4. Persuasion *30*

4. CONTRAST CASES **33**

4.1. HEALTH CARE – SAFETY LEADERSHIP FOR RELIABILITY 33
4.2. AVIATION: QUALITY IS NOT THE SAME AS SAFETY 35
4.2.1. Decomposition assumptions of quality management *37*
4.2.2. Toward a new regulatory future: Making judgments of resilience *39*

5. WHERE TO GO FROM HERE **43**

6. CODA **44**

6.1. SAFETY LEADERSHIP IN THE LITERATURE 44
6.1.1. Leadership commitment *44*
6.1.2. Values & policies *45*
6.1.3. Personality & style *47*
6.1.4. Visions & goals *48*
6.1.5. Communication *48*
6.1.6. Employee participation *50*
6.1.7. Safety culture *51*
6.1.8. Responsibility & accountability *53*
6.1.9. Behavior-based safety process *55*
6.1.10. Safety Assessment *56*
6.2. THEORETICAL CONTEXTUALIZATION 57
6.2.1. Science, objectivity and constructivism *57*
6.2.2. Leadership theory *60*
6.3. DISCUSSION OF THE SAFETY LEADERSHIP LITERATURE 67

6.3.1. Critical observations *67*
6.3.2. Safety culture *69*

7. REFERENCES **72**

Summary

In traditional safety approaches, a great amount of concern of leaders was focused on achieving reliability through convincing employees to follow regulations. To increase reliability, efforts to reduce the number of uncontrolled events and actions are put in place. Such efforts have been aimed at reducing the unpredictability in technological functioning and human behaviour. Leadership for reliability, in other words, focuses on making it impossible for people to behave unsafely. In the vocabulary of constructivism, it was about constructing roles that were predictable and reliable, and success would be achieved by the employees showing a strong identification with all these regulations in the roles they adopted. This, however, is an extremely limited and quickly counterproductive way to exercise safety leadership.

In complex, safety-critical industries, the goals should be resilience, not reliability. Resilience is about enhancing the capability of people and processes to recognize, adapt to and absorb challenges that fall outside what they have been designed for. Given the enormous complexity and (to some extent) unpredictability of the processes governed, reliability is neither entirely achievable nor desirable. Instead, resilience is about enhancing people's adaptive capacity, not constraining it. Resilience is more focused on enhancing the organization's capacity to cope with variability, rather than just being reliable. Consequently, the role-construction should be aimed at more flexibility. Leadership for resilience, then, is about acknowledging, providing and constantly improving the room that people need to perform a job safely.

Limitations of the current research base

The current research base for safety leadership is unsatisfying as the literature lacks several important aspects of a conceptualization that is up to date with current philosophical and theoretical views on safety and leadership. It is based on rationalistic, universalistic and essentialist accounts of leadership effects on safety.

We argue for a social constructivist approach instead, one that can track how safety leadership is created through the use of language and rituals. We propose to focus on four dimensions with which to look at safety leadership: identity (what roles and identities are created and expected), story (the narratives that leadership refers to and how they are interpreted), strategy (what leaders wish to establish) and persuasion (how they go about

establishing that and get others to follow). Together, these dimensions give us powerful new empirical tools to crack some of the more difficult-to-capture parts of safety leadership.

Fast forward through the report

In this report we first try to form a new understanding of safety leadership, because of the fundamental limitations of earlier conceptualizations (these are dealt with in detail in the theoretical coda—the second half of the report). We base the new understanding of safety leadership on the idea of resilience (rather than reliability), which has important implications for the role of leadership in balancing pressures for production with those of safety. With this understanding, we then deconstruct the current research base, and build up a new understanding of safety leadership, around the four dimensions mentioned above. We conclude with two contrast cases, one from healthcare and one from aviation. These serve to illustrate where other safety-critical industries are in their understanding of safety leadership and the difference between reliability and resilience (or quality and safety). From there, we provide some possible directions forward. The remainder of the report is dedicated to an in-depth theoretical analysis of existing research on safety leadership (itself critical for appreciating the direction taken in the first half of the report).

In advanced socio-technical organizations, with high competency demands on employees, safety leadership is more about providing the room to perform a job safely than about making it impossible to do the job unsafely. To assume that people will do things wrong if they are not told exactly how to do things, is not the point. The assumption should rather be that people will do things safely unless the conditions for this are unfavourable. Safety leaders who want to increase resilience should focus on construction of roles which allow people to do things safely.

Sammanfattning

Traditionellt har ledares oro inom säkerhetsområdet fokuserats på att uppnå tillförlitlighet genom att övertyga medarbetare att följa regler. För att öka tillförlitligheten införs åtgärder för att reducera antalet okontrollerade händelser och ageranden. Sådana åtgärder har riktats mot att reducera oförutsägbarheter i teknisk funktion och mänskligt beteende. Ledarskap för tillförlitlighet fokuserar med andra ord på att göra det omöjligt för människor att bete sig på ett icke säkert sätt. Utifrån ett konstruktivistiskt synsätt handlar detta om att konstruera roller som är förutsägbara och tillförlitliga och framgång ska uppnås genom att medarbetare visar en stark identifiering med alla dessa regler i de roller de antagit. Detta är dock ett väldigt begränsat och snabbt kontraproduktivt sätt att utöva säkerhetsledarskap.

I komplexa, säkerhetskritiska verksamheter borde målen vara riktade mot resiliens (återhämtningsförmåga) och inte tillförlitlighet. Resiliens handlar om att öka människors och processers förmåga att känna igen, anpassa sig till och hantera utmaningar som faller utanför vad dom varit avsedda för. Med tanke på den enorma komplexitet och (i viss mån) oförutsägbarheten i de styrande processerna så är tillförlitlighet varken helt möjligt eller önskvärt. Istället handlar resiliens om att förbättra människors anpassningsförmåga och inte begränsa den. Resiliens är mer fokuserat på att förbättra organisationens förmåga att hantera variationer snarare än att bara vara tillförlitlig. Följaktligen bör rollkonstruktionen riktas mot större flexibilitet. Ledarskap för resiliens handlar alltså om att erkänna, tillhandahålla och ständigt utöka det handlingsutrymme människor behöver för att utföra ett jobb på ett säkert sätt.

Begränsningar i den aktuella forskningen

Den aktuella forskningen för säkerhetsledarskap är otillfredsställande eftersom litteraturen saknar flera viktiga aspekter av en konceptualisering som är uppdaterad med aktuella filosofiska och teoretiska synsätt på säkerhet och ledarskap. Den bygger på rationalistiska, universalistiska och essentialistiska redogörelser om ledarskapets påverkan på säkerheten.

Vi argumenterar för ett socialkonstruktivistisk synsätt istället, ett synsätt som kan spåra hur säkerhetsledarskap skapas genom användning av språk och ritualer. Vi föreslår att fokusera på fyra dimensioner genom vilka man kan titta på säkerhetsledarskap: identitet (vilka roller och identiteter som skapas och är förväntade), berättelse (de berättelser som ledare refererar till och hur dessa tolkas), strategi (vad ledarna vill etablera) och övertalning (hur de går

till väga för att etablera strategin och får andra att följa). Tillsammans utgör dessa dimensioner ett nytt kraftfullt empiriskt verktyg för att se igenom några av de mer svårfångade delarna av säkerhetsledarskap.

Snabbspolning framåt genom rapporten

I denna rapport har vi först försöka bilda en ny förståelse för säkerhetsledarskap på grund av de grundläggande begränsningar som finns i tidigare begreppsbildningar (dessa behandlas i detalj i den teoretiska codan – den andra halvan av rapporten). Vi baserar den nya förståelsen för säkerhetsledarskap på resiliensidén (motståndskraft och återhämtningsförmåga snarare än tillförlitlighet), vilket har stor betydelse för rollen som ledare när det gäller att balansera produktionstryck och säkerhetskrav. Utifrån denna förståelse dekonstruerar vi sedan aktuell forskningsbas och bygger upp en ny förståelse för säkerhetsledarskap runt de fyra dimensioner som nämnts ovan. Vi avslutar med två kontrasterande fall, ett från sjukvården och ett från luftfarten. Dessa är tänkta att illustrera var andra säkerhetskritiska industrier står i sin förståelse för säkerhetsledarskap och skillnaden mellan tillförlitlighet och resiliens (eller kvalitet och säkerhet). Därifrån ger vi några möjliga riktningar framåt. Resterande del av rapporten ägnas åt en fördjupad teoretisk analys av befintlig forskning om säkerhetsledarskap (i sig avgörande för att kunna värdera den inriktning som tagits i den första halvan av rapporten).

I avancerade sociotekniska organisationer med höga kompetenskrav på medarbetare så handlar säkerhetsledarskap mer om att ge utrymme för att kunna utföra ett jobb på ett säkert sätt än om att göra det omöjligt att utföra jobbet på ett icke säkert sätt. Att anta att människor kommer att göra saker fel om de inte får veta exakt hur man ska gör saker, är inte poängen. Antagandet bör snarare vara att människor kommer att göra saker på ett säkert sätt om inte villkoren för detta är ogynnsamma. Ledare i säkerhetskritisk verksamhet som vill öka sin organisations resiliens bör fokusera på att skapa roller som tillåter människor att göra saker på ett säkert sätt.

1. Understanding Safety Leadership

In advanced socio-technical organizations, with high competency demands on employees, safety leadership is more about providing the room to perform a job safely than about making it impossible to do the job unsafely. To assume that people will do things wrong if they are not told exactly how to do things, is not the point. The assumption should rather be that people will do things safely unless the conditions for this are unfavourable. Safety leaders who want to increase resilience should focus on construction of roles which allow people to do things safely.

Safety leadership is a crucial ingredient in the creation of organizational safety. The notion that leadership has a considerable influence on organizational matters, in particular on safety, might not be controversial. But as will be shown in this report, safety leadership is a concept that has neither been satisfyingly investigated, nor understood. In fact, many people who speak about safety leadership simply recycle previous theories of organizational safety and leadership. This leaves an important area underexplored, something we hope to address in this report.

Recent insights in research on organizational safety focus on the connection between safety and production efficiency. These two goals are a primary concern for any organization. In complex socio-technical organizations, e.g. those in the nuclear industry, these goals have been identified as conflicting ones (Woods 2006: 26-29). Our aim in this report will be to clarify the concept of safety leadership and its role in this balance between safety and production efficiency. Previous ideas of safety leadership have failed to do so and have done little to increase our understanding of the connections and interaction between safety and production efficiency. In the theoretical coda, we will identify and extensively discuss limitations in theory that have prevented previous conceptualizations of safety leadership from achieving a satisfactory understanding. Even though understanding theoretical limitations is critical, in the first part of this report, we want to get on with developing a new perspective and research outline and provide the necessary tools for understanding how leadership contributes to the dynamic balance between safety and production efficiency in organizations such as nuclear power plants.

The theoretical coda of this report then presents a detailed analysis of the literature on safety leadership. This includes a critical account of where the literature is lacking regarding its fundamental assumptions about safety and

leadership as well as regarding safety engineering viewpoints. The literature which discusses different aspects of safety connected to leadership (e.g. literature on safety management, safety culture and risk management) is vast. This analysis will focus on literature which has safety leadership as its explicit main concern. The amount of such literature is limited, which in itself is an indicator of the need for further investigation of safety leadership.

2. Leadership for resilience

Traditional approaches to safety, including the literature on safety leadership, have focused on *reliability*. To increase reliability, efforts to reduce the number of uncontrolled events and actions are put in place. Such efforts have been aimed at reducing the unpredictability in technological functioning and human behavior. Leadership for reliability, in other words, focuses on making it impossible for people to behave unsafely. This, however, is an extremely limited and quickly counterproductive way to exercise leadership.

In complex, safety-critical industries, the goals should be *resilience*, not reliability. Resilience is about enhancing the capability of people and processes to recognize, adapt to and absorb challenges that fall outside what they have been designed for. Given the enormous complexity and (to some extent) unpredictability of the processes governed, reliability is neither achievable nor desirable. Instead, resilience is about enhancing people's adaptive capacity, not constraining it. Leadership for resilience, then, is about acknowledging, providing and constantly improving the room that people need to perform a job safely.

One problem with the pursuit of reliability is that it is based on overly simplistic accident models (Rochlin 1999: 7, Hollnagel 2004 Chapter 6: 9-11). Hollnagel presents three different models of accident analysis which represent three different perspectives on safety. The sequential model regards accidents as the outcome of a sequence of events where the last event represents the accident. This model provides an unambiguous cause for the accident. It has however proved not to be complex enough to explain accidents in socio-technological systems. This type of accident analysis is based on focus on root-causes and that reliability is achieved through the elimination or containment of them. The epidemiological model represents another perspective on safety. It regards accidents as the outcome of numerous latent and active factors combining to form an unfortunate junction of preconditions and events in time and space. In this sense all systems harbor the potential for accidents but their occurrence depends on the "right" combination of factors. The remedy of this "unhealthiness," i.e. lack of safety, is the introduction of an increasing number of safety barriers and defenses. A common feature of these two models is that they view safety as the outcome of managing the parts of the system by either eliminating risky events or introducing safety barriers (combined with redundancy). They both assume that this will result is an organization that is safe.

The third family of accident models is the systemic. In these, safety is an emergent property of the system, not the result of a certain setup of the different parts of the system. Through the couplings of technological and social aspects within the system various emergent properties arise and hopefully safety is one of them. Risk analysis and probabilistic safety assessment are methods that to calculate the appropriate safety measures by focusing on the system individual components of the system. This means that effects of couplings within the system are not considered and a system with reliable components, redundant design and employees performing their work safely still is experiencing accidents.

This has caused a shift away from focus on reliability and on to a focus on the resilience of an organization. Resilience refers to the capability of handling and recovering from events and outcomes which are unanticipated and surprising. With increasing complexity of sociotechnical systems it becomes more difficult to foresee possible routes that may lead to accidents. The concept of redundancy can be used to illustrate this. Increasing redundancy is an important method for increasing reliability in a system; by introducing several independent barriers reliability is increased. From a systematic perspective on safety there might however be unintended couplings between these barriers and the rest of the system that may cause unexpected events. Sagan (2004: 936-937) provides an illustration of this with an example from the nuclear industry. Redundancy was increased through the introduction of a zirconium plate inside a reactor. This decreased the risk that materials would burn through the containment walls. Unfortunately this component contributed to an event which had a potentially catastrophic outcome, by falling off and blocking the pipe which provided cooling to the reactor. This example shows the difficulty of calculating all the possible outcomes in complex organizations. This need for new strategies to deal with safety in complex organizations gave birth to the field of resilience engineering.

As mentioned, resilience engineering regards safety not as something which we can measure or analyze through calculations or estimation of probabilities, since safety is the emergent outcome of coupling of components within a complex system. To stay resilient an organization should stay constantly monitor the performance of the system (Hollnagel & Woods 2006a: 347-348). Research from failures within complex organizations has showed that the failure of safety is not the result of erratic or error-prone individuals. Safety is dependent upon the adaptability of individual workers and accidents are the result of a systematic drift towards

failure caused by changes and pressures in the organization. In a perfect system work is executed as planned, the behavior of the system is predictable and the conditions for work are designed in response to this predictable behavior. In reality this is rarely the case. Instead, there is variability in the system's performance, in the conditions for work and consequently in how work needs to be performed. In order to be safe an organization need to manage this variability (Hollnagel 2004 Chapter 5: 2-7).

2.1. Leadership – Balancing safety and production pressures

Leadership that aims to contribute to resilience is focused on awareness of organizational decision-making and its consequences. Leaders should monitor their own decision-making processes in order to detect when there is risk of drift towards safety boundaries. This may be difficult, since safety is one of numerous goals of an organization. The most important goal conflict in an organization is normally that of safety versus production efficiency.

Organizational pressure to increase productivity might have negative consequences for other goals, typically safety. The changes that management introduces in order to achieve increased productivity can put the organization on a path towards its safety boundaries without this being intended, anticipated or detected. Being aware of such drift is a critical aspect of a leadership aiming for a resilient organization (Woods 2006: 26-27) and being able to balance these conflicting goals is a crucial part of resilience. This is expressed through the knowledge of when to relax pressures on production to be able to maintain risk at a controllable level. If an organization would constantly prioritize production efficiency over safety, they would be exposed to unacceptable risks, at the same time as any organization must balance safety concerns with those of being productive in order to stay competitive (Ibid. 29). Adaptability is one of the crucial abilities of a resilient organization. Being able to adapt to changing conditions and balance competing goals is critical. In a complex system, there is not one best way of balancing production and safety. This must be dynamically updated to follow the variability in the organization's performance (Woods & Cook 2006: 70-72).

Connected to this problem is the gap between work as imagined and work as it is actually performed. Operators at the sharp-end of an organization often have to make trade-offs between production and safety goals. The result is a gap between work as it is formulated in regulations and policies and the work as it is actually carried out. This gap is not caused by the negligence of

operators. It is an outcome of the difficult task of being efficient enough to meet production goals as well as thorough enough to meet safety goals. Adapting work to changing conditions is a necessity in order to achieve a successful production outcome. Research on aircraft maintenance has shown that a large amount of work is being done without adhering to procedures (Hollnagel 2004 Chapter 5: 16-19). This highlights one of the problems with the reliability approach; operators sometimes need to move away from reliability in order to maintain resilience. In order to be resilient the gap between the perception of what is going on and what is actually going on needs to be reduced. If management does not know how work is carried out it is difficult for them to know how to adapt work to changing circumstances and when they do introduce changes these might be mismatched to how work is performed (Dekker 2006: 86-88).

Part of this concern is a paradoxical issue of the need for stability and flexibility. In order for an organization to be safe it needs stability regarding its work process and use of procedures; standardizations of routines and adherence to them are important aspects of organizational performance. This increases the reliability of the work being done by reducing variation in how it is carried out as well as the organization's dependence on the skill of individual worker. Safety is however also dependent on flexibility in the form of informal work practices and local decision-making (McDonald 2006: 155-160). From a leader perspective this is problematic, since it demands that leaders contribute to structures that may seem to be contradictory.

2.2. Applications of resilience to the regulator

We have presented some of the challenges that leaders face when they are trying to contribute to resilience in an organization. Consequently, the Resilience Engineering approach has some propositions regarding organizational properties to consider when monitoring organizational performance. The main one is the balance between safety and production efficiency. Other aspects of organizational performance which need to be considered in order not to let the organization move towards the safety boundary will be illustrated by examples from the Swedish nuclear industry. These applications are selected from investigations and evaluation-reports on Swedish nuclear industry (SKI Rapport 2005:53, Inspektionsrapport 2005-05-26 ref. 9.09-040988 & Inspektionsrapport 2003-09-26 ref. 6.09-030904).

This is by no means an investigation in itself of how leaders in Swedish nuclear industry are contributing to the resilience of their industry, but rather exemplifications of resilient properties or lack thereof. Another purpose of these examples is to show how our theoretical focus on leadership as discourse can be active in the construction of resilience. The material provided is reports and analyses themselves, which is not an ideal material for a discourse analysis, but examples can be extracted to illustrate our main points. The aim is to show that it is not only what is obvious that is interesting, but how language is constructing the reality of safety in organizations.

This section here will start off with some general examples to illustrate the challenges in balancing production and safety. These examples will be made concrete through a reference to the 'generalklausul', which will serve as one point of analysis in how the discourse of safety may be constructed in different ways. Other areas of Swedish nuclear operations will also be included to further illustrate the concept of resilience. Here is an example of the 'generalklausul,' as represented in local technical regulations (or Särskilda Tekniska Driftförutsättningar STF):

När en allvarlig brist i en barriär eller en allvarlig brist i djupförsvaret har konstaterats, eller när det föreligger en grundad misstanke om att säkerheten är allvarligt hotad, skall anläggningen utan dröjsmål bringas i säkert läge. Anläggningen skall även bringas i säkert läge utan dröjsmål då anläggningen visar sig fungera på ett oväntat sätt eller då det är svårt att avgöra vilken betydelse för säkerheten en konstaterad brist har. (this mirrors SKIFS 1998:1 2 kap. 2 § sista stycket)[1]

The chapter will then continue with two other areas which have been identified as important properties in the balance of production and safety and for maintaining resilience in an organization:

- Revision and update of models of risk
- The coordination and structural arrangement.

[1] In English: *When a severe deficiency in a barrier or a severe deficiency in the defence-in-depth system has been observed, or when there is reason to suspect that safety is severely threatened, the facility shall be brought to a safe state without delay. The facility shall also be brought to a safe state, without delay, when it is found that the facility is functioning in an unexpected manner, or when it is difficult to determine the importance of a deficiency for safety.*

Balancing production and safety

Regarding trade-offs between production efficiency and safety leaders need to contribute resources for these to be managed safely. When operators experience a pressure to give higher priority to production the time to be able to be thorough may decrease. The timing of relaxing pressures on production in order to be safe is crucial. Experience has shown that the greatest need for investment in increased safety often coincide with when the pressures for increased production are at their peak (Woods 2003: 4). The often implicit pressures for production efficiency can be very hard to handle for operators. This pressure might arise in the form of perceived demands from management or from worries of peer reactions if a sacrifice regarding production turns out to be unnecessary in hindsight (Woods 2006: 32). In order to stay safe leaders have to develop strategies to invest in safety when the organization is experiencing the high production pressures. This investment needs to be deployed in a timely and proactive manner to avoid drift towards failure. But there also need to be stability in leaders' commitment to make these investments to achieve a constant support in conflicts between acute (production) and chronic (safety) goals.

To maintain resilience, policies clearly state that safety always takes priority over production efficiency and that there should always be enough resources allocated to meet the safety goals. These policies are essential from a resilience perspective; still the erosion of safety margins may occur implicitly. Since Swedish nuclear plants are operated to be profitable not only the formal decision-making processes are of interest. What is usually referred to as 'organizational culture' can contribute to operators perceiving a demand to be more efficient than justifiable from a safety-perspective, or - in the vocabulary of social constructivism - the discourse on safety might be leaning towards production efficiency. Therefore it is important to be constantly aware of whether the need to be profitable interferes with safety goals or with how they are perceived.

So when analyzing the leaders' performance in the construction of safety operator statements are of great interest. The same is true for policies, since these also have a considerable effect on the discourse of safety. The 'generalklausul' is a policy that is active in the construction of a discourse regarding the balance between production efficiency and safety.

By explicitly stating that a nuclear plant should be brought into safe-mode as soon as there is uncertainty in the functioning of the plant (or when the seriousness of an established deficiency in the safety is not known) a strong

mandate for a priority of safety is provided. It voices a clear priority of safety since uncertainty is enough for bringing the plant in to a safe mode. But as the construction of the discourse on safety has more sources than explicit policy formulation, and to achieve an understanding of the balancing of safety and production in the actual work, it is interesting to look at statements made by operators. The statements of several control-room shift supervisors (CKR) at Barsebäck serve as good examples of this discourse. They claim that in situations of anomalies they can always contact superiors and discuss whether the 'generalklausul' should be applied, and usually consensus is achieved. But if there is disagreement, the shift-leader has the right to apply the 'generalklausul' even if superiors don't agree with it. This statement illustrates a discursive construction which contributes with resilience, since it is a situation where safety-priority is achievable. However, other statements illustrate that the situation is not always this simple. When there is disagreement on a safety matter this should be documented, but neither the shift leader nor the drift leader interviewed has seen this type of document (Inspektionsrapport 2003-09-26: 15). This implies that the discussion that usually ends with consensus on whether to apply the 'generalklausul' or not is of interest in the discursive construction of safety.

Although the data we have does not allow any such discussion, it is possible that the dialogue between the shift leader and his superiors reveal how production and safety is balanced in day-to-day operations. Other members of the organization express that the 'generalklausul' can be applied without it being questioned. The head of production expressed uncertainty over whether she has seen a documentation of disagreement, but adds that it would take a lot for her to go against the shift leaders decision, unless her decision is more conservative (Inspektionsrapport 2003-09-26: 16). Another example of where a discourse of safety is of interest is in the way leaders on different levels express their commitment to safety. The site manager claims that he has made explicit efforts to limit the role of economic matters in the organization (Inspektionsrapport 2003-09-26: 13). All these cases show how a discursive construction of the balance, or how language is used in the balancing, is of importance in understanding how leadership in this balancing act is played out in the organization. By looking at how language constructs the actual prioritizing, an understanding of leadership performance can be achieved.

Also worth mentioning here is how this balance is handled by the design of the decision-making process within Swedish nuclear plants. Such a discussion is not primarily involved in an analysis of the discourse on safety,

since it is an analysis of the organizational setup. But it can still have discursive effects on safety or resilience, since the organizational setup of involving several actors in the decision-making process opens up for other discursive practices than those which the organization's senior leadership would have contributed with on their own initiative. In order to safeguard against erosion of safety-goals in the decision-making process different actors are involved. This includes external partners as well s cross-checking groups who are not involved in line-operation, but more concerned with technical safety-issues. In addition, decisions made are followed up by other authorities. Involving actors who are external to the performance of the organization is of importance since these are more likely to be able to disregard from production pressures. Another aspect of the decision-making process which contributes to resilience is that the base for any decision is concerned primarily with safety and that there are explicit and detailed rules for how to uphold the quality of safety (SKI Rapport 2005:53: 64-73). All these features contribute to a resilient decision-making process that avoids letting production pressures cause the organizations to drift towards failure.

These are different examples of how a discourse analysis could be fruitful in understanding how the balance between production efficiency and safety is played out in the organization. Note that it is not only language-related situations which are of interest, e.g. the organizational setup is also of interest. Any entity that is capable of exerting influence on how reality is constructed is of interest in an analysis of discourse.

Models of risk

A critical aspect of staying resilient and proactive (in order to avoid drift in the balance of production and safety) is that of updating and revising the models of risks that the organization accepts as true. The mistake of taking past success as a guarantee for avoidance of future failures is apparent when these models are not updated in a timely manner. Timely in this context refers to not needing an overwhelming amount of evidence to initiate an update of the understanding of incidents and minor accidents. Sensitivity to early signals is important in order to prevent drift. Lack of anticipation of adverse events, resulting in surprises when accidents occur, is often a result of inadequate understandings of the risks an organization is facing(Woods 2003: 4).

Although it is very difficult to ever know whether a model is accurate regarding its judgment of risk, the activity of constantly questioning models

of risk is important (Dekker 2006:90-92). It is likely that organizations will disregard troubling information if it has no explicit procedures for such questioning (Woods 2003:5). A task for leaders aiming to increase the resilience of an organization is to develop effective methods for monitoring, questioning and revision of its own models of risk. Revisions should not have to be prompted by a great amount of evidence since the existence of such evidence can be the result of a long slide towards the boundaries of safe operation. Leaders who want to promote resilience need to create openness to criticism of the organizations' understanding of risk to stay informed on potential weaknesses.

Illuminative examples of monitoring and revision of risk models, as well as lack of this, are displayed in the inspection-reports. Even though the reports show that routines for monitoring and revision of risk models exist, these seem to be oriented towards immediate concerns for the operators, while a more general monitoring and updating of models of risk seems to be lacking. This could be a potential contributor to a problem of knowing when the power plants are drifting towards the boundaries of safety. As mentioned earlier, the 'generalklausul' states that the plant should be brought in to safe-mode as soon as any anomaly is displayed, and is an example of a very conservative and safety-oriented mode of operations. Typically, operators express their concern for the difficulty of judging whether there actually is a problem or anomaly. As any form of work easily develops into routine, even events which should be considered as potential risks may become considered as 'normal work'. In part because of a huge base of standardized responses to pre-specified operational problems, operators express that they feel that there is a strong mandate to question operations and communicate concerns (Inspektionsrapport 2005-05-26:7).

Although operators explicitly claim that the problem with judging potential risk is countered by the strong mandate of questioning how things are done, this is difficult. Within discourse analysis there is a concept of hegemonic interventions, which refers to situations where antagonism between discourses are forced to an end through the hegemony of one of them. In this case such a situation is implied in the apparent downplay of problems associated with not knowing of when to report a safety issue by referring to a strong mandate. The belief in the strong mandate as a solution to this constructs a discourse of safety which does not fully recognize the problem of judging risk in a specific situation. Whether this is the result of production pressure or of taking past success as a guarantee for continued success is difficult to judge. A similar situation is indicated by statements regarding increased willingness to report as something that grows via on-the-job

training (Ibid: 8). Although this probably is true in any organization (i.e. that experience increases the ability to be safe) the implication that only employees with specific experience and expertise are competent to report safety problems may be problematical.

This is an example of problems connected to the recommendation of monitoring and revision of models of risks, since despite the fact that there seems to be a high awareness of the need to be prepared to step out of the "chain of command" (which would also be a marker of a resilient structural arrangement of handling events between different units of the organization) there still is an uncertainty of when the organization is actually facing a risk. An analysis of discourse could highlight how this informal procedure actually plays out. How are the situations where the questioning takes place constructed?

The STARK concept

What could be characterized as some sort of formal model for revision and monitoring is the STARK-concept, which calls for every operator to reflect and communicate potential problems and always put safety before other concerns. Another example of conflicting discourses is statements made in connection to the STARK-concept. It is seen as a supportive structure for acceptance of potential risks as threats to safety. Although time-schedules are very tight, there is a mandate to put safety first, as it is expressed. Here the conflicting discourses of efficiency and safety is reconciled through a hegemonic intervention of safety-priority. The same dynamic as is identified in the section on balancing production efficiency and safety seems to be present here. Although the material does not allow us to make any final claims, there is a potential that discursive constructions of safety priority hide antagonisms between the goal conflict. Statements to the contrary are provided in the reports as many of the operators claim that focus on production efficiency has decreased in later years, both in policies and rhetoric (Inspektionsrapport 2005-05-26: 11).

From a resilience perspective, this illustrates the need of a more coherent formalized plan for monitoring and revision that is inclusive of operational aspects throughout the organization. As one of the functions of updating and revising models of risk is to identify drift towards failure it is important to that questioning and revision includes am overall perspective on operations. Although the combination of openness towards questioning and conservative safety policy (generalklausul) serves as a contributor towards an awareness

of the potential for unanticipated risks, similar procedures on other levels in the organization are needed. Signs of unwillingness to learn from established channels of international experience-feedback have been identified in Swedish nuclear industry by the regulator. This unwillingness and its part in role in discursive construction are of central interest for understanding safety and resilience in the industry.

Coordination and structural arrangement

Another highlighted issue within resilience engineering is the need for strategies to develop a coherent problem-perception. To avoid failure all members of an organization need to be updated on the operational risks they are facing and the organization must have a complete picture of how the potential for failure is managed. Leaders should develop strategies for training and coordination regarding potential risks for failures (Woods 2003: 5-6, Woods 2006: 316). Experience has shown that intra-organizational communication must be effective to meet threats from anomalies. If employees stay within the normal chain of command, there is a definitive risk that the organization will remain far too rigid to meet dynamic threats. Even if there are strategies to discover and report dangerous anomalies, these will not be effective if there are no explicit efforts to meet conflicts in priority-settings across different organizational units (Woods 2003: 7-8).

The statement in the 'generalklausul' that the plant should be brought to and held in safe mode in any uncertain situation claim a certain order of action, starting with the identification of the problem, followed by an analysis and the development of a plan of counter-measures, the coordination of production-disturbance and finally a routine for what can be learned from the event. The inspection-reports present some examples which illustrate how this process of actions has been coordinated within the Swedish nuclear industry which are useful for further analysis from a resilience perspective.

The generalklausul and safety leadership

Safety leadership expressed in formal policies provide explicit recommendations on how to manage the situations covered by the 'generalklausul' regarding who should be put in charge of the counter-measures deployed and on how risks involved in the event should be analyzed. The claim is that there is a good coordination of events connected to anomalies. An example of this is that when the shift-leader experience that a safety-related event has occurred it is up to him to decide if the

‘generalklausul’ is applicable or not. But the shift-leader (if there is time) may seek advice higher in the organization or from his team. Coordination for different scenarios is made explicit and experienced by operators as well-known and applicable in practice. The same goes for the coordination of responsibility during an event, since whenever an event has been analyzed, an “owner” of the problem is assigned who has the responsibility managing it. From a constructivist point of view, the designation of an owner is interesting. If for example the shift-leader identifies an event as a potential safety risk, this does not mean that the head of operations for a reactor unit will come to the same conclusion (Inspektionsrapport 2005-05-26: 10). How are these ‘truths’ constructed in the social interaction of problem ownership-designation? Problems in the structural arrangement could be identified here, e.g. if there are problems in the agreement of whether events should be identified as risks or not. The authors of the report identifies this as a problem and express a wish for more explicit justification of the decisions, justification which also would be interesting to review in a discourse analysis.

In general there are not many concerns expressed in the reports which could be interpreted as expression of priority-conflicts between different units of the organization. If there are explicit routines for handling of events, analysis of them and development of counter-measures as well as role-assignment, it is likely that a response will be structured and coherent. Another aspect of this capacity to handle anomalies through the structural arrangement of safety management, is the fact that reactor-safety always takes priority. This is a safeguard against fragmentation of the decision-making process. However, a potential problem of coordination is expressed in the concern for lack of training for situations when the ‘generalklausul’ is applied (Inspektionsrapport 2003-09-26 ref. 6.09-030904: 12). A successful coordination of anomaly-handling is of course not only dependent on formal routines but also on continuous training of such events. This training, or the lack of it, is active in the construction of resilience. The understanding of operators on how to apply training in actual situations is something which could be captured in a discourse analysis.

These are issues which need to be addressed in the decision-making process of an organization, if leaders want to develop a safety leadership which is resilient. The suggestions made here try to point to aspects of leadership that can contribute to the ability to balance safety and production and increase awareness of the changing and dynamic risks an organization might face. They also show several different empirical areas where a discourse analysis will expose the construction of safety prioritizing and safety management.

Such an understanding will deepen the ability to understand the conditions for creation of resilience.

3. Safety Leadership – Deconstructing the research base

The current research base for safety leadership is unsatisfying as the literature lacks several important aspects of a conceptualization that is up to date with current philosophical and theoretical views on safety and leadership. It is based on rationalistic, universalistic and essentialist accounts of leadership effects on safety.

We argue for a social constructivist approach instead, one that can track how safety leadership is created through the use of language and rituals. We propose to focus on four dimensions with which to look at safety leadership: identity (what roles and identities are created and expected), story (the narratives that leadership refers to and how they are interpreted), strategy (what leaders wish to establish) and persuasion (how they go about establishing that and get others to follow). Together, these dimensions give us powerful new empirical tools to crack some of the more difficult-to-capture parts of safety leadership.

So what are essentialism, universalism and rationalism? Essentialism assumes that there is actually such a thing—readily recognizable—as "good leadership" since it contains essential elements. As we will see, this assumption does not work: what is "good leadership" hinges on who looks at (and may be recipient of) the behavior construed as "leadership". Yet essentialism is rife in the literature about leadership (good leadership has several essential properties, depending on what theory you adhere to). Universalistic assumes that what counts as leadership is not dependent on context; that the essential ingredients carry over non-problematically from situation from situation. This assumption is demonstrated by the existence of simplistic, top-down perspectives on how management of safety can work through the presumed modification of employee behavior. The rationalistic perspective in the literature influences the view of human behavior and its role in safety. Human behavior is largely analyzed as a safety problem and views on accountability are linked to the need for punishment and discipline in the organization in order to uphold alignment around safety goals in the organization.

Social constructivism

In keeping with current developments in social sciences, and to ensure that we deliver the most up-to-date theories and create the greatest possible leverage for progress, we have chosen to study and describe safety leadership from a social constructivist perspective. The focus of social constructivism is to uncover the ways in which people participate in the creation of their perceived reality. It involves looking at the ways in which social phenomena (of which leadership is one) are created, institutionalized and even made into traditions by humans. From this perspective, most of the theoretical assumptions behind the different views that are presented in the theoretical coda are problematic, since they rely on essentialist theories of leadership (most notably different versions of transformational leadership theory). From a constructivist point of view, any account of leadership needs to consider the constitutive aspects of leadership as a social activity. This social activity (which is supported, mediated, if not created by language) helps construct the social reality of an organization.

In accordance with the theoretical tradition of post-structuralism, then, social construction is active through language. This means we must focus our attention of safety leadership to the discourse of safety in an organization (discourse literally meaning spoken or written communication). Focusing on discourse will also allow us to pick fruitful empirical directions forward (i.e. what should we be studying in more detail in the discursive interactions between leaders and others in a nuclear power plant?)

The new theoretical paradigm within systems safety and resilience engineering has shown that safety is not what it has been assumed to be in previous literature. In complex socio-technical organizations it is not sufficient to look for a root-cause (in human behavior or in unreliable components) in order to improve safety in an organization. Instead, safety is an emergent property which is dependent upon the flexibility of human behavior that actively is anticipating different paths to failure. Leaders aiming to increase the resilience of an organization should improve the adaptive capacity of their people; enable and empower their people to be proactive and flexible in times of uncertainty and change. In the discussion that follows, we combine the insights of constructivist perspectives with those of resilience engineering.

3.1. Deep Leadership

Theories on safety leadership are often based on different notions of the most effective leadership style. Concepts on leadership style vary from loose ideas on how leadership influences followership, to those based on more coherent theories of leadership. For example, "transformational leadership" has been influential on safety leadership literature. Theories originating from notions of preferable personal traits in leaders have also had their fair share of attention in the literature. A constructivist understanding of leadership tries to move away from such assumptions since they are philosophically questionable and practically intractable. Not only in the sense that such a perspective denies that leadership is about certain traits or styles, but also in that leadership would be a possession of an individual or a group of individuals high up in the organizational hierarchy. If leadership is about managing change, or at least the potential of change, a useful concept of leadership should look at informal as well as formal leaders, all across organizational hierarchies. In conventional approaches to leadership, it is assumed that leader abilities are possessed by the CEO, the leader of a work-team or whoever is designated as the leader in a particular context. But if leadership is a social relation, and the concern is its performance, leadership could just as well be seen as a relation distributed throughout the organization.

The view of leadership as a deep relation within the organization claims that change is achieved through members of the organization at all levels. One might think this makes leadership some arbitrary spiraling organizational flow which easily would become fuzzy, and meaningless. This, however, is not the case, since our conceptualization moves the focus from individual traits and normative accounts of actions to performance aspects of social relations. To make it concrete, safety leadership can just as well be the CEO changing formal safety policies, as an operator persuading his co-workers to do things in a different way than previously done (Grint 1997: 115-145). This is a perspective that is well aligned with how resilience needs to be considered, i.e. it should be of concern for all levels in an organization.

But if we cannot speak normatively about traits, styles and behavior-based leadership (as
in: a leader should have this or that, or should do this or that), then what can we say? In order to provide some structure to an account of safety leadership, we need some dimensions of assessment in order to understand whether the safety leadership helps providing resilience or not.

3.2. Assessment dimensions

Even if safety leadership in the perspective proposed here is seen as something constructed and constructive, it does not mean that everything is arbitrary about it. It is true that constructivist approaches turn away from essentialist ideas on the best way to do things, but there are still dimensions in leadership situations which can be considered and 'evaluated' (although the scientific connotations of the word might seem problematic in this context).

From the ideas of constructivist leadership theorist Keith Grint (2000), any leadership, and its effectiveness, could be characterized in four different dimensions.[2]

- **Identity**: Understanding how leadership is constructed within an organization by looking at which social identities are constructed in order to fulfill the ambition of leadership.
- **Story**: Understanding how leadership constructs a narrative of the organization, i.e. what kind of 'stories' leadership refers to in their leading activities and how they are interpreted by the followers.
- **Strategy**: Understanding what leadership wants to establish, and whether and in what way this is followed.
- **Persuasion**: Understanding what means of communication leadership employs in its efforts to convince the followers to follow.

Examples of different properties of resilience will now be applied to these different assessment dimensions. These examples are not meant to be exhaustive, but will serve as ideas on how the further study could be carried out by using these dimensions.

3.2.1. Identity

In general constructivist leadership theory, the construction of identity is crucial. The task is concerned with constructing a sense of 'we', in order to create a common followership (Grint 2000: 6-13). In the world of national politics, this task has been fundamental in the nation-state projects of the last centuries. For example, in postcolonial Africa, getting to change the citizens' perception of themselves as belonging (identifying) with ethnic categories of

[2] Note that this is not an objectivist, normative account normally found in leadership theories, saying that everything about leadership could be summarized in four themes. It should more be seen as a proposed scheme from which we can understand (safety) leadership.

pre-colonial origin, to that of the nation-state has been an often violent and bloody process (Cheru 2002: 193). Part of the reason is probably that leaders adopt strategies to change people's ideas of who they are, which naturally can be quite a provocative business. Luckily, this is probably not the case for safety leadership within a nuclear organization. The process of constructing identities is nevertheless important if we want to understand the role of leadership in safety. The identities of concern here are connected to the construction of professional roles and specifically how safety is a part of these roles. More to the point, the concern is how responsibilities and tasks relating to safety are connected to different positions. In order to follow the constructivist assumptions this area needs to be addressed on the follower side of the organization, specifically regarding how employees in the nuclear industry relate their roles to their safety responsibilities.

An empirical assessment of safety leadership should be concerned with how it facilitates and encourages resilience in the organization. In the area of identity, the assessment should be concerned with how leadership in their construction of roles in the organization can respond to and develop the organization according to these recommendations.

In traditional safety approaches, a great amount of concern of leaders was focused on achieving reliability through convincing employees to follow regulations. In the vocabulary of constructivism, it was about constructing roles that were predictable and reliable, and success would be achieved by the employees showing a strong identification with all these regulations in the roles they adopted. Resilience is more focused on enhancing the organization's capacity to cope with variability, rather than being reliable. Consequently, the role construction should be aimed at more flexibility.

In advanced socio-technical organizations, with high competency demands on employees, safety leadership is more about providing the room to perform a job safely than about making it impossible to do the job unsafely. To assume that people will do things wrong if they are not told exactly how to do things is not the point. The assumption should rather be that people will do things safely unless the conditions for this are unfavorable. Safety leaders who want to increase resilience should focus on construction of roles which allow people to do things safely.

Language and discourse

Since the empirical focus of social constructivism is on language, our concern will be how the discursive construction of roles and identities connected to safety is played out in the organization. Such an empirical interest can look at how leadership expectations are formulated on how things are supposed to be done. Providing detailed descriptions on how to perform actions related to safe operation is an example of a safety leadership trying to provide reliability. Reliability is not necessarily the opposite of resilience, so in order to understand whether this is also providing resilience or not, we must follow the constructivist dictum and look at the follower as well. How does the operator interpret the regulations in times of uncertainty? Are they seen as a resource for making decisions or are they perhaps seen as a source of intimidation which obstructs flexibility when unknown situations arise? From a resilience perspective, the latter case would of course be problematic.

Resilience and incident reporting

An important activity of specific importance in resilience engineering is the questioning of how work is performed as well as reporting of safety-related matters. As described in the chapter on leadership for resilience, this is connected to the need to update and revise models of risk, but also to how production pressures and safety are balanced. The empirical focus here can be aimed at how operators experience the reporting system as well as at leadership attitudes towards reporting. Since discourse is a result of not only what is explicitly stated in language, but also of how the material and structural context forms our representation of it, the formal setup of feedback channels is also part of the discursive construction of professional roles in the organization.

Another important property in providing resilience is that of the coordination and structural arrangement. One aspect of this was the possibility to train handling of anomalies, in order to achieve a successful coordination of management of safety-related events. This is a safety leadership activity of importance for the construction of identity. Identity, or professional role, is partly adopted by employees during training, e.g. simulator training. Their experience and application of this training is also of interest in understanding the discursive construction of roles and identities.

These dimensions form a few aspects of the construction of professional roles and identities which is important to consider in an evaluation of the effectiveness of safety leadership.

3.2.2. Story

The construction of a story or narrative of the organization is also considered as a crucial part of effective leadership in a constructivist understanding. To use the analogy of the nation-state again, it refers to the construction of a common myth. In the case of Sweden, this myth is discursively constructed through a common history with certain formative moments which shaped what Sweden is today, as well as the construction of symbols uniting us as a people. This could be the flag, our king, our national anthem or the national football team. This is not to say that such a construction of a national myth is a lie or a deception of the people. It is just to say that certain representations of reality serves the purpose of making people identify themselves as belonging to a country (Grint 2000: 13-16).

Even though there certainly are some quite important differences between leading a nation and leading a complex socio-technical organization safely, the same dynamics apply. Organizational leadership in general and safety leadership in particular, should not be less concerned with a construction of the past and more with a construction of the future. Grint refers to this activity as the invention of a vision (Grint 2000:16), and in the context of safety leadership this is about the formulation of a safety vision. To avoid that the vision is communicating trivialities, an analysis of this should go beyond what the focus of the literature on safety leadership, i.e. that of formulating visions that are easy to remember and putting them on the wall of the operator room etc.[3]

Connecting this to resilience, it may be useful to look at how the constructions of organizational stories discursively balance production and safety. To make things simple, requesting people to do things fast and safe has other effects than requesting people to do things safe and take their time if needed. Naturally, it is rarely this easy to judge this balance in reality. But the empirical focus should be as is exemplified in the chapter on leadership for resilience. By assessing the formulation of policies and regulations in combination with exploration of operators' perception and understanding of them, an understanding of the discursive construction of the balance of

[3]This is not to claim that such efforts are completely uninteresting in a discursive construction of safety, but just saying that we want to look at other things than the obvious.

safety and production can be achieved. The empirical focus can also move higher up in the organizational hierarchy, since the main influence over the balancing act probably is found there. For example, how is the organizational story constructed by leaders in their perception and application of demands (production) from the owners, in combination with their concern for safety?

The need to update and revise models of risk is also an area that could be connected to this assessment dimension. A more static construction of the organizational story may contribute to get the organization stuck in old perceptions of its operations. If this construction is more dynamic and questioning, the visions pursued will be more up-to-date with the risks the organization faces. Therefore an analysis should focus on the discursive construction of risk-perception. A resilient approach would typically incorporate questions and concerns on operational matters raised by members of the organization. Problematic signs could be found if an organization rarely changes its perception of its operations, or in constructivist language, does not change its organizational story.

To summarize, the story of an organization is important to consider if we want to understand leadership's part in how desired operational performance is constructed. The effectiveness of the story is understood through understanding how the followership perceives
it.

3.2.3. Strategy

Leadership theory is largely concerned with establishing the best way of leading. This concern is born out of the indeterminacy of leadership. Throughout history the dynamic of leadership as the factor that made a difference in outcome has been identified. This difference is basically focused around the fact that the objective strengths of two sides do not necessarily determine who will win the battle of the two
sides. This is caused by the fact that strategic ingenuity could make up for lack in strength in resources (Grint 2000: 16-22). For example, during the 2nd World War, the Germans managed to resist the allied forces during the last stages of the war far longer than an 'objective' analysis of the resources of the two sides would predict. It has been claimed that the reason for this is that the German military leaders used their resources more effectively than the leadership of the allied forces did. It is in this gap the strategy of leadership comes in. In any leadership situation there can be a gap between

what can be achieved through an 'objective' analysis of the resources and what is actually achieved. This is partly the result of the deployment of strategies, i.e. ways of using resources to achieve the goal of the organization. It is important to remember that this is not the kind of analysis rationalistic accounts would do that is claiming an identification of the 'optimal' strategic solution. It is rather an analysis which looks at different strategies and their construction of reality.

When applying this to safety leadership, the focus should be on the safety goals which are constructed in an organization, and how these are strategically pursued. An analysis of the construction of safety goals can be similar to the analysis of the construction of the organization story. But if the story is an analysis of the organization's safety narrative, this area is more concerned with the construction of resource deployment. Applied to resilience a good example is the area of coordination and structural arrangement. Comparison of safety goals with structural arrangement of how events are managed can provide an understanding of the organization's safety strategies, as well as reveal potential lacks and gaps in the strategies deployed. The analysis should of course be combined with other areas of analysis, as for example with that of the organizational story.

The discursive construction of the organization's story in combination with the construction of how problems are managed (e.g. regarding problem ownership-designation) can be a powerful way of understanding these issues. While conventional approaches focus more on explicit formulations in an analysis of organizational structural arrangement and coordination, our analysis (as in all other areas) will focus on more non-rational aspects of this. The construction of safety strategies, i.e. structural arrangements for coordination of efforts regarding safety-related events, is a discursive construction, not only a rational formulation of these aspects. This analysis should move focus to the aspects exemplified in the chapter on leadership for resilience, on situations where language acts as the medium for how the strategy plays out.

3.2.4. Persuasion

The last assessment dimension is that of persuasion. To achieve their goals leaders must persuade its followership to do what the leaders have planned. This issue is concerned with construction of belief in the organizational project. Leaders belief in the rationale of pursuing profit, honor or whatever their organization's goal is, does not necessarily mean that this belief is

shared by their followers. To achieve this some sort of persuasion has to be involved. This is reflected in transformational leadership theory, where the individual rationality of employees should be transformed into rationality in line with organizational goals. Although a constructivist understanding of leadership differs from that of transformational, since it stays away from such rationalistic reasoning, it still recognizes the need to communicate its objectives to the followers in different ways. To put it in another way, in order to make the followers adapt to identities, believe in the story and follow the strategy, the must be persuaded to do so by some sort of communication channels (Grint 2000: 22-27).

When turning to safety leadership this concern is two-sided. One side is the traditional idea of how leaders (that is, management higher up in organizational hierarchy) can communicate safety goals and policies to people lower in the hierarchy. The other is how operators communicate their safety concerns upwards in the organization. Note that different areas of assessment links and interact in many ways, but the point is not to use these four dimensions to establish four areas of safety leadership, but more to analyze the same flow of construction
from four different aspects, and they all aim at understanding the same thing; the discourse of safety in the organization.

The dimension of persuasion connects to several aspects of resilience. The communication of safety concerns is crucial in the balancing safety and production efficiency, especially from the side of operators, since upper management needs to consider their concerns in their decision-making in order not to move towards safety boundaries. This is also connected to the need of updating and revising risk models. The ways persuasion, or communication constructs the organization's perception of risk will have effects on their safety efforts. The same goes for handling and coordination of anomalies as this is also dependent upon communicative constructions within the organizations. How the coordination and structural arrangement is communicated or persuaded throughout the organization will influence how these efforts turn out in the handling of anomalies.

Summarizing, in this assessment dimension the focus will turn to the discursive events which are centered on convincing, educating and persuading people to do things in a certain way in areas connected to the properties of resilience. Consequently it will be intertwined with the other assessment dimensions. Since the aim is not to present four different dimensions of safety leadership, but to use the assessment dimensions as

four different approaches to a constructivist understanding of safety leadership, this is a strength of the assessment process.

4. Contrast cases

In order to show how different view safety leadership, this section will provide two asymmetric contrast cases—one taken from a leadership program in Swedish health care and one from a recent aviation accident. These will serve as examples and illustrations of how industries at different levels in development of safety leadership handle some of the issues that have been discussed in this report.

4.1. Health Care – Safety Leadership for Reliability

In order to gain an insight in how Swedish health care handles leadership issues connected to patient safety and how this can be understood from the perspectives put forward in the report, one of the authors of this report took part in a seminar on patient safety in Swedish health care in Jönköping 7th – 8th Dec 2006. This seminar was organized as a support for leadership in health care in their efforts to work out and implement a strategic plan for improvement of patient safety. This will in this chapter serve as an example of how Swedish health care handles the issue of safety leadership.

This program was partly initiated due to the fact that patient safety management has been identified as underdeveloped. The reporting system is mostly based on incidents, and does not provide good possibilities for learning and improvement. In order to counter these deficiencies in patient safety management the program introduces a strategy which will improve the standards in different steps.

The first step is to acknowledge the fact that things need to be improved. This could be done through a formulation of a strategic vision where the specific patient-related areas that is supposed to progress are identified, e.g. the reduction of unnecessary suffering or deaths due to unreliable routines in health care. The implementation of this strategy should be connected to new methods and tools to improve learning and potentiality to be proactive in patient-safety. These aspects are part of the objective of establishing a good safety culture, e.g. a non-punitive atmosphere that would increase report-willingness and event- and risk analyses that would increase reliability (Franzén 2006).

The event and risk analyses form specifically interesting areas to discuss as they serve as useful examples of the contemporary perspective on safety leadership in Swedish health care. The event analysis is supposed to be

implemented whenever a patient is seriously injured or could have been seriously injured. It is constituted by an identification of the root causes through systematic gathering of data and an analysis of the appropriate countermeasures in shape of protections and barriers that will prevent the same event to happen again.

The risk analysis on the other hand is constituted by methods to evaluate the risks in different areas and processes in the health care system. These methods also include ways to measure the size of the risks as well as ways to identify the causal factors behind the risk. This will provide the opportunity to reduce the risks to acceptable levels. The recommendations for risk analysis also briefly states that changes at an organizational level also should include a risk analysis, although this is more complicated and demanding (Händelseanalys och riskanalys 2005: 11-45).

Another aspect of the strategy to improve patient safety is to develop measures in order to get assessable clinical results from the new safety strategies. These could be in the form of data from the Patient Insurance, mortality rates or healthcare related infections. All these serve to provide data in order to be aware of the current state of patient safety management (Franzén 2006). The overall aim of this strategy is to achieve an organization of high safety with systematic learning and proactive risk-awareness.

The chapter on leadership for resilience provided some illustrations on how organizational safety concerns have gradually moved from a pursuit of reliability through a reduction of uncertainties in human and technological performance, to trying to achieve resilience, which is a capacity to handle the unexpected. As the complexity in socio-technical organizations has increased, more and more problems with only focusing on how to increase reliability has been identified. Instead a greater interest in how to handle the unexpected has developed.

The strategy presented during the seminar is a good example of an organization that is trying to increase its reliability. Many times during the seminar it was mentioned that one of the major concerns is the lack of explicit and reliable routines in different aspects of the health care process. The aims to counter these problems through for example event and risk analysis are examples of ways to reduce uncertainty. This could be both at systemic as well as individual levels. In this way their stage of development of safety leadership programs are at a different level than the one we are trying to develop in this report. As has been thoroughly described our aim is much more focused on a safety leadership for resilience, not reliability. This

is both shown in the differences of where problems are situated (in this report the balance of production efficiency and safety is the main concern, in health care it is uncertainties in processes of the system), but also in the methods proposed to counter these problems. To reduce uncertainty in health care quantitative methods are recommended. For understanding the intricate dynamics in the balance of safety and economy in an organization this report proposes sociologically interpretative methods.

4.2. Aviation: Quality is not the same as safety

A recent aviation accident demonstrates that the reductionist model we apply to understanding safety and risk (taking systems apart and checking whether individual components meet pre-specified criteria) no longer works well. Through a concurrence of functions and events, of which a language barrier was a product as well as constitutive, Helios 522 may have been pushed past the edge of chaos, that area in non-linear dynamics where new system behaviors emerge that cannot be anticipated using reductive logic. Complexity theory, in contrast, encourages us to fix on higher-order system properties if we want to gain confidence about the resilience of a system, i.e. its ability to recognize, adapt to, and absorb a disruption that falls outside the disturbances the system was designed to handle.

Quality and reliability or safety and resilience

Flight Operational Quality Assurance (FOQA) has become mandatory for most large aircraft operators. In its most general sense, Quality Assurance is a system of management activities to ensure that a process, an item, or a service, is of the type and quality demanded by applicable requirements. Quality assurance, then, is about checking whether components or systems meet certain pre-specified criteria. Quality assurance and safety management within the airline industry are often mentioned in the same sentence or used under one department heading. The relationship is taken as non-problematic or even coincident. Quality assurance is seen as a fundamental activity in risk management. Good quality management will help ensure safety. Checking whether individual constituent components of a system meet certain pre-specified criteria expresses a particular model of risk and safety. It implies a particular idea about where sources of trouble lie and a model of how accidents occur. Accidents are assumed to occur when individual components or processes fail to meet applicable criteria or migrate outside of pre-specified boundaries. Flight Data Monitoring (FDM/FOQA), an

important ingredient in airline quality assurance, builds on the idea that safety, once established, can be maintained by keeping the performance of a system's constituent components within certain bounds (people should not violate rules, flight parameters should not exceed particular limits, acme nuts should not wear beyond this or that thread, and so forth).

Regulators have now followed this logic for a while too. Their safety oversight, under pressure of resource constraints and efficiency demands, has also oriented itself more toward the examination of operators' quality and safety management systems. This strategy ostensibly allows regulators to fix on higher-order variables and not, for example, send safety inspectors after every single nut and bolt that goes into an aircraft to match it against individual specifications. The idea is that if an airline's quality and safety management systems are in order, most constituent components are likely to be in order too. The practice is called "system oversight" (or self-regulation). Put crudely: you check the system, not the individual components.

The August 2005 Helios B737 accident can pose some really interesting questions about the relationship between quality assurance and safety. It raises the possibility that the inspection and safety assurance regimes applied by the industry are increasingly at odds with the accident models it still assumes to be true. Checking whether individual components meet pre-specified criteria, and keeping system performance within externally dictated bounds (e.g. through FDM/FOQA) may not protect us from another accident like this one.

Language as Disabling Device

The two cockpit crew members aboard Helios flight 522 met the pre-specified European criteria for acting as co-pilot and captain, respectively, on a Boeing 737. Preliminary insights suggest that after take-off from Cyprus, the aircraft did not pressurize well because of anomalies in its pressurization system (International Herald Tribune, 2005). The configuration warning system sounded an alarm after take-off—as designed. This is the same horn that goes off before take-off if the aircraft is incorrectly configured (in for example its flap setting) for getting airborne. This may have set a stage for confusion about what was ailing in the aircraft, if anything—a confusion that became compounded by an accelerating mental disorientation resulting from hypoxic hypoxia (cabin pressurization normally keeps the cabin altitude at about 8000 feet).

The aircraft, as programmed, kept climbing on autopilot. When it passed 14,000 feet, oxygen masks deployed in the cabin, and a master caution light illuminated in the cockpit. About the same time, another alarm started sounding on a slightly related matter, warning that there was insufficient cooling air entering the compartment housing avionics equipment. Confusion escalated. The German captain and Cypriot copilot discovered that they did not have enough common ground in English to begin coordinating meaningfully about the problems at hand. This type of swelling situation—a creeping pressurization problem with seemingly unrelated, irrelevant or intrusive alarms —would have pushed any crew (impaired by hypoxia) far off the beaten track where standard ICAO English still sufficed. None of the two cockpit crew members onboard Helios 522 may have commanded enough English to understand the other's attempts at, or proposals for, fixing the problems. Nor did they speak each other's language. Crew coordination beyond routine checklist items and air traffic control clearances would be strenuous, labored, inefficient, arduous, ultimately acrimonious and ineffective.

Upon calling the carrier's maintenance base in Cyprus, they were advised that the circuit breaker to turn off the loud new alarm was in the cabinet behind the captain. The captain got up from his seat to look for the circuit breaker, leaving the confused co-pilot behind at the controls. The aircraft continued to climb on autopilot, and the air grew so thin that the captain passed out first, on the cockpit floor, followed by the co-pilot, who was still in his seat. The autopilot continued to do what it was programmed to do: fly the aircraft to Athens at 34,000 feet and enter a holding pattern. It remained there, shadowed by Greek military jets, until fuel ran low and one engine quit. The thrust imbalance caused the 737 to leave the holding pattern, and it crashed not much later.

4.2.1. Decomposition assumptions of quality management

If we believe that safety can be maintained by keeping system component performance within applicable bounds (and we partially express that belief in Quality Assurance) the combination of a properly trained and certified German captain and Cypriot co-pilot of Helios 522 would have been unproblematic. This is because we make certain decomposition assumptions (see Leveson, 2002). For example, we assume that each component or sub-system operates reasonably independently, so that the results of our safety analysis (e.g. inspection or certification of people or components or sub-systems) are not distorted when we start putting the pieces back together

again. It also assumes, by the way, that the principles that govern the assembly of the entire system from its constituent sub-systems or components is straightforward. And that the interactions, if any, between the sub-systems will be linear: not subject to unanticipated feedback loops or non-linear interactions.

The pictorial representation of the popular accident model of the nineties (the Swiss Cheese: subsequent layers of defense with holes in them, see Reason, 1990) may unintentionally sustain and propagate these decomposition assumptions. The sub-systems (e.g. layers of defense) are represented independently, the entire system is assembled straightforwardly from a series of layers, and their interrelationship is linear (the "accident trajectory" through them is a straight line, going through one layer after another). If these assumptions were valid for the systems we inspect and regulate, then looking for the quality of individual components or sub-systems would suffice. But they aren't and it doesn't. Not anymore (cf. Amalberti, 2001).

If what we know now is true, then Helios 522 violates these assumptions. The German captain and the Cypriot co-pilot met the criteria set for their jobs. Even when it came to English, they passed. They were within the bandwidth of quality control within which we think system safety is guaranteed, or at least highly likely. That layer of defense—if you choose speak that language—had no holes as far as our system for checking and regulation could determine in advance. And we thought we could line these subsystems up linearly, without complicated interactions. A German captain, backed up by a Cypriot co-pilot. In a long-since certified airframe, maintained by an approved organization. The assembly of the total system could not be simpler. And it must have, should have, been safe.

Yet the brittleness of having individual components meet pre-specified criteria (e.g., being able to talk standard ICAO English to the satisfaction of an applicable examiner) and think they interact only linearly, would not have been brought to such stark light, were it not for the compounding problems that pushed demands for crew coordination off the routine. A German captain (or Cypriot co-pilot), whose English is sufficient to cover the necessary ICAO utterances, cannot be considered independent of the other crew members he is going to be interacting with, and cannot be considered independently from the possible problems that may have to get solved through efficient crew coordination under pressures of uncertainty, noise, time limitations, and waning oxygen.

Failing to cope with complexity

A system failure such as Helios 522 is not mainly a story about component failures, at least not at any interesting level. (Of course, such an accident story may well be constructed for Helios 522, as it has been for other accidents. But one accident, given its complexity and multifaceted nature, can always be carried in various ways by multiple competing accident stories—none of which is more privileged than others to speak the "truth"). Helios 522 represents the temporary inability to cope effectively with complexity. This is true, of course, for the cockpit crew after climbing out from Larnaca, but this is even more interesting at a larger system level. It was the system of pilot and airline certification, regulation, in an environment of scarcity and competition, with new operators in a market role which they not only fulfill but also help constitute beyond traditional Old Europe boundaries—that could not recognize, adapt to, and absorb a disruption that fell outside the set of disturbances the system was designed to handle (see Rochlin, 1999; Woods, 2003; Hollnagel et al., 1996). The "stochastic fit" (see Snook, 2000) or functional resonance (Hollnagel et al., 2006) that put together this crew, from this airline, in this airframe, with these system anomalies, on this day, outsmarted how we all have learned to adapt, create and maintain safety in an already very safe industry.

The probability of such stochastic concurrences would not seem to be going down in Europe either. Nor the potential consequences. Consider the increasing reliance on cabin crew from new, lower-wage, Eastern European member states in an environment of aggressive competition—an industrial-ecological niche where some low-cost carriers flourish. Language barriers there could perhaps easily deplete problem solving capabilities, especially with problems elsewhere in the aircraft that require coordination across cockpit and cabin crew. And, if history is any guide, traditional, largely monocultural flag carriers may be forced to follow the mix-and-match low-wage suit too—eventually. Helios 522 with only two non-overlapping languages, in just the cockpit, could be a mere beginning, a hint.

4.2.2. Toward a new regulatory future: Making judgments of resilience

Moves towards "system oversight" put regulators and certifiers in a second-order role relative to their previous position. Rather than wanting to know exactly what problems an airline, or other inspection object, is having (e.g. bolts of the wrong size), the regulator wants to get an idea of how well the airline is able to deal with the problems that will come its way. The inspector, in other words, is trying to make a judgment of the resilience of

the inspection object. The intention to help create safety through proactive resilient processes, rather than through reactive barriers, is laudable and productive. But the critical question is what to base a judgment of resilience on. This question is only beginning to be examined.

Today, if the inspection object has a good quality system, then a regulator may assume that its ability to adapt to deal with novel and unanticipated problems—its resilience—is relatively well-developed. But the strategies we currently deploy for assuring safety (e.g. checking a quality management system, which in turn checks whether individual components or processes or items meet pre-specified requirements) occupy only a slice of the knowledge base for generating safety in complex, risky operations. This knowledge base is inherently and permanently imperfect (Rochlin, 1999), and no contemporary logics of rulemaking and inspection can arbitrate in any sustained way between what is safe or unsafe. The criteria used, after all, represent only a particular portion of the knowledge base, a particular model of risk, of what makes operations brittle or resilient. In a world of incomplete knowledge, of resource limitations and changing hazards, we have to assume that this representation, as any other, is a coarse approximation that covers the target world only partially, and may likely be obsolete.

As Helios 522 shows, the quality of individual components or sub-systems (even if these are higher-order sub-systems, such as an airline's recruitment practices or maintenance arm or manual tree or event reporting system) may say little about how those sub-systems and components could stochastically and non-linearly recombine to outwit the best efforts at anticipating pathways to failure.

Complexity theory and system safety

For the past few centuries, our central analogy for understanding how systems work has been the machine, and our central strategy reductionism. To understand how something works, we dismantle it and look at the parts that make up the whole. This implies that we can derive the macro properties of the system (e.g. safety) as a straightforward function of, or aggregation from, the lower-order components or subsystems that constitute it. Helios 522 could begin to question whether this is enough, or applicable at all. By dissecting a system and inspecting its parts, we "kill" it and cannot know what gives it its life.

Shifting from a machinistic interpretation of complex systems to a systemic one implies giving up the reflex to look mainly at parts. A machine can be controlled, and it will "fail" or perform less well or run into trouble when one or more of its components break. In contrast, a living system, according to the systemic understanding of life, can only be disturbed (see Capra, 2002), which is much less binary, and potentially much more resilient. Failure is not necessarily the result of individual or compound component breakage, but is more related to the ability of the system to adapt to, and absorb variations, changes, disturbances, disruptions and surprises. If it adapts well, absorbs effectively, then even compound component breakages may not hamper chances of survival. United 232 in July 1989 is a case in point. After losing control over the aircraft's control surfaces as a result of a center engine failure that ripped fragments through all three hydraulic lines nearby, the crew figured out how to maneuver the aircraft with differential thrust on two remaining engines. They managed to put the crippled DC-10 down at Sioux City, saving 185 lives out of 293.

The principles and patterns of organization of a living system are unlike those of machines, and we need a different mathematics, for example that of complexity theory (nonlinear dynamics) to begin to model its intricacies. Complexity theory tries to understand how simple things can generate very complex outcomes that could not be anticipated by just looking at the parts themselves. It has found that small changes in the initial state of a complex system (e.g. A Cypriot and German pilot, rather than, say, two Cypriot ones) can drastically alter the final outcome. The underlying reason for this is that complex systems are dynamically stable, not statically so (like machines): instability emerges not from an interaction between components, but from concurrence of functions and events in time. The essence of resilience is the intrinsic ability of a system to maintain or regain a dynamically stable state (Hollnagel et al., 1996). For us to begin to understand how systems (e.g. the European wide system of proficiency-checking and safety regulation) dynamically create safety, we should first acknowledge that:

- Practitioners and organizations continually assess and revise their approaches to work in an attempt to remain sensitive to the possibility of failure. Efforts to create safety, in other words, are ongoing. Not being successful is related to limits of the current model of competence, and, in a learning organization, reflects a discovery of those boundaries.
- Strategies that practitioners and organizations (including inspectorates) maintain for coping with potential pathways to failure

can either be strong or resilient (i.e. well-calibrated) or weak and mistaken (i.e. ill-calibrated).

- Organizations and people can also become overconfident in how well calibrated their strategies are. Effective organizations remain alert for signs that circumstances exist, or are developing, in which that confidence is erroneous or misplaced (Rochlin, 1993; Gras, Moricot, Poirot-Delpech, & Scardigli, 1994). This, after all, can avoid narrow interpretations of risk and stale strategies (e.g. checking quality of components).

One concern driving the development of nonlinear dynamics and resilience engineering is the search for the edge of chaos, a point of emergence beyond which new system behaviors can emerge that could not have been predicted using decompositional logic. Escalating circumstances onboard Helios 522, of which language as a disabling device was not only a victim but also constitutive, can be said to have pushed crew coordination capabilities past such a "tipping point", the point in complexity theory where stability is overtaken by instability; order supplanted by chaos.

The "system" meant here is not just an inspection object (airline, maintenance organization) or any of its sub-units, but could be a system at a higher level, e.g. European-wide safety regulation. The questions to get confidence about the resilience of the system apply at that level too. The most important ingredient of engineering a resilient system is constantly testing whether ideas about risk still match with reality; whether the model of operations (and what makes them safe or unsafe) is still up to date. An accident such as Helios 522 may suggest that the aviation industry, in Europe, may still be applying models that no longer are.

5. Where to go from here

In this report we have proposed a constructivist approach to safety leadership. Drawing from insights of resilience engineering, a constructivist approach will provide us with a new understandings of how leadership discourse functions in the balance between safety and production. By moving away from conventional approaches, the perspective we have taken may shed more light on some of the complex interactions of leadership activities that handle this balance.

These understandings will be achieved through access to empirical data in nuclear power plants. By applying the assessment dimensions proposed to different kinds of data suitable for investigating the processes of the construction of discourses within nuclear leadership contexts, we will be able to better understand safety leadership. This data could be interviews, documentary investigations as well as participatory observations, as the design of methods will partly develop as the investigation proceeds. The outcome of this will be a constructivist understanding of safety leadership and better ways to support leaders in the nuclear power industry exercise their leadership in the balance between production pressure and safety. It will also be an understanding that works out some of the challenges put forward by the field of resilience engineering.

6. Coda

6.1. Safety leadership in the literature

Different perspectives on the role of leadership in organizational safety can be found in the literature. There are, however, certain recurrent themes which will be discussed in the following chapters. The analysis in this coda by no means presents all of the themes covered by the literature. It will, however, present those which have appeared frequently and which constitute the main perspectives in safety leadership.

6.1.1. Leadership commitment

One of the principal issues in safety leadership is the commitment to safety shown by management. Simply expressed, it refers to the principle of leaders being able to "walk the talk", as in showing employees a commitment to safety not just through the explicit formulation of rules and procedures, but also through their own behavior. The literature points to the fact that establishing and maintaining such credibility are not simple tasks (Krause and Hidley 2004, Fleming 1999). The leader's awareness and knowledge of what is actually important in the organization's particular safety situation is crucial for this. From this standpoint the literature points to certain areas of leadership that need to be developed in order to develop and sustain this credibility.

The starting point in much of the literature regarding safety credibility is the motivation for leaders to commit themselves to safety. But the commitment needs to go beyond an intellectual recognition of the importance of safety, and transcend into an emotional one. One way to convincingly argue this is through highlighting the highly uneconomical consequences of disregarding safety. Some literature also claims that emotional commitment might arise from other behaviors, such as a direct management involvement in workers conditions and an increased understanding of their exposure to hazards (Roughton & Mercurio 2002: 3-15, Thomen 1991).

So which areas of leadership need to be addressed in order to show commitment? Krause and Hidley (2004) point to the importance of self-knowledge for credibility. A leader might judge his commitment to safety by his intentions, but this is not the standard by which he will be judged by his employees, since they will focus on his or her behavior. A credible leader must be aware of the impact of his actions on

the employees and how these actions will be perceived by them. In addition, openness to critique and acceptance of advice from others are important features of a credible leader. Another aspect is that safety-related matters have to be in tune with how work is carried out in the organization. Safety regulations which are not based on how the work is done will not be considered credible by experienced ground-staff workers.

Fleming (1999) highlights another aspect: involvement of the workforce in assessment of safety and management of risks. This will provide the leader with information on how work is done and increase employees' feelings of being valued for their expertise. Also, by staying visible through frequent visits to the workplace, the credibility of the leader increases. Not as a result of concrete actions connected to the visits, rather more by the apparent interest shown by the leader.

Roughton and Mercurio (2002:32) make the same point when they stress the need of interaction between leaders and subordinates. By demonstrating a genuine interest in the employees' situation leaders can establish credibility.

6.1.2. Values & policies

A subject close to that of leadership commitment is that of values. If commitment is formulated as a general recommendation in the literature, discussions on the role of values has a more explicit form. Primarily, leaders need to consider the impact of values on behavior. This is intimately connected to the priority of safety in an organization. Even though Thomen (1991) provides many financial reasons for leaders to give safety a high priority, Krause (2005) also stresses that safety should be seen as an intrinsic value tied to leadership commitment to employees' working conditions and health. If commitment is more clearly demonstrated for other goals, such as profit, and safety perceived only as a mean to reach these goals, this could erode attitudes to safety among employees. Due to this, leaders should focus on and develop personal values that put the welfare of the employees in the center. If a lack of such values is perceived in any leadership position this can grind down the credibility of all leaders and create the need for intervention by senior leader to re-establish it. In short, leaders should internalize safety priority as a core value to be considered in all decision-making processes (Krause & Weekley 2005).

Not only personal values of leaders are of importance to safety. Several authors (e.g. Roughton & Mercurio 2002: 20-24) recognize organizational

values as an important source of influence on the behavior in an organization, in particular for issues connected to safety. Values formulated by an organization interact with personal values of managers and employees to form aggregate values and norms for an organization. In this respect, values are often discussed as a significant feature of organizational and safety culture.[4] Understanding the values that guide safety-related behavior is fundamental for any organization where safety is of primary concern.

Values need to be discussed not only at a general organizational level. They also need to be integrated with safety policies. When leader have recognized the values they believe will enhance safe behavior in their organization, these need to be made explicit in a safety policy. The idea behind this is that if such values and policies are clearly stated and communicated at all levels in an organization they will have an impact on individual behavior and increase the safety of the organization. Opportunities to discuss these values and policies will increase the chance that decisions made in everyday work will be made on the basis of them (McSween 2003: 26-28).

Safety also needs to take more concrete forms than the mere explication of the values that are intended to govern the organization. Formulation of a safety policy is part of such an effort. The literature points to the need for such a policy to be clear and avoid banality. It should be helpful in guiding the daily work of all employees. It should declare leadership commitment to safety, straightforwardly communicated to the organization, not unlike the ideas of safety values. But this commitment also needs to be integrated with practice by explicit rules and recommendations. An effective safety policy can support the implementation of the values regarding safety and guide employees to work according to the intentions of the more abstractly formulated values. Put in another way, expressed values and leadership commitment can transform from abstract theories into operationalized work. Thomen (1991) have formulated specific recommendations on what such a policy should consist of. For example, a safety policy should state the fact that any accident can be avoided, that it is the responsibility of management to avoid accidents, but also that safety is achieved through the employees. Note however, that these explicit recommendations are not widespread in the literature on safety leadership.

[4] A more thorough discussion of the concept of safety culture, as well as leadership's role in safety culture is provided elsewhere in the report.

6.1.3. Personality & style

Aspects of personality and leadership style that may effectively enhance safety are discussed in the literature on safety leadership. These discussions focus on a wide range of aspects, from preferred personality traits to various styles of leadership.

As for personality, the general literature on leadership does not provide a coherent account on all the theories and ideas that has been put forward in this area.[5] But when it comes to safety leadership there seems to be some consensus on this subject (although it should be noted that only a few authors bring it up). Theories produced by research on personality traits, e.g. the big five personality factors, has inspired Krause (2005: 27-44) to suggest the kind of personality that could provide efficient safety leadership. The big five personality factors are: emotional resilience, extroversion, learning orientation, collegiality and conscientiousness. All these factors can be translated to desired personal abilities in a safety leader. Emotional resilience decides how a leader will manage a safety crisis. Extroversion is a personality trait of importance for leader's interaction with employees. Learning orientation is related to a leader's openness and ability to take in and make good use of knowledge and experience. Collegiality (or agreeableness) refers to the capacity of the safety leader to create good relations and trust in the organization. Conscientiousness reflects a safety leader's ability to balance attention to detail and focus on the whole picture (Krause & Weekley 2005).

The same authors have put forward ideas on which style of leadership that may be efficient in creating safety. Based on recent theories regarding the transformational leadership style, they argue that this is to be preferred rather than the traditional transactional leadership. While transactional leadership is based on the argument that people act out of self-interest and leaders must continuously reward good behavior, transformational leadership goes beyond this to transform the organization and inspire people to be guided by other values than self-interest (Killimett 2006).

[5] Elsewhere in this report different theories on leadership styles, as well as a discussion on the role of personality in leadership effectiveness is found.

6.1.4. Visions & goals

Establishing visions and goals for safety forms an essential part of many author's arguments in regard to safety leadership. It is seen as important for a safety leader to be able to align people towards a common vision or goal, since safety is depending on the actions of many different actors in the organization. Any safety program or safety process is recommended to start with 'having the end in mind' (McSween 2003: 24-26). A vision should be formulated as a far reaching inspirational statement for an organization and be accompanied by a clear mission statement. Both should be recognized throughout the organization to guide the actions of its members. Leadership responsibility in this part is central, since effective safety leadership is dependent upon leaders being able to envision how safety can be enhanced. Visions and goals can contribute to an alignment of employees that result in a coherent safety effort by the whole organization (Roughton and Mercurio 2002: 52-55, Killimett 2006, Ruchlin et al. 2004: 49-50, Krause and Hidley 2004).

The proposed importance of visions and goals on safety is based upon rather broad ideas on how they should be formulated. Thomen (1991: 310-311) argues that these should be stated for specific areas where results can be easily measured. The idea is that goal achievement will provide the organization with energy to continue improving its safety. In this sense, general ideas of formulating common visions do not provide an effective use visions and goals (Thomen 1991: 310-311). Roughton and Mercurio also write make a clear distinction between visions and goals for safety. Goals are in their view more shorthanded and achievable than visions, and also more explicitly formulated (Roughton and Mercurio 2002: 74-94).

6.1.5. Communication

In all safety leadership activity communication is identified as crucial for its success. No efforts of leaders to improve safety will be successful unless they are accompanied by effective communication. The central task is communicating safety visions, policies and goals. But this topdown communication needs to be combined with bottom-up feedback, since any safety effort needs to be updated with information on the actual situation regarding safety in the organization. Closing this gap between leader's perception of the organization and how work is actually carried out is stressed as a fundamental aspect of safety leadership in many of the books. This makes it essential to provide channels for feedback for employees to ensure that there is a flow of information about actual safety performance

that will reach leaders. Different ideas on how this should be organized are presented in the literature, everything from vague recommendations of 'speaking to the employees' to very detailed descriptions on how safety meetings between managers, supervisors and ground-level staff should be organized. But the common theme is, as mentioned, that there needs to be an exchange of information in both directions in an organization if the safety efforts are to have any effect (Thomen 1991: 359-361, Krause 2005: 138-139).

Another aspect of communication that is found frequently in the literature is that of recognition. The idea that recognizing positive efforts by members of the organization has a string positive effect on the overall outcome of safety efforts is widely held in the literature. Such recognition typically takes the form of verbal recognition of behavior that improves safety, but the literature also suggests that formal awards and compensation programs may be effective. If safe behavior is motivated by its connection to the financial success of an organization financial compensation to the individuals who are responsible for improving safety should be relevant (McSween 2003: 102-118).[6]

There is however some caution voiced against safety awards and compensation programs, since they might pressure employees into not reporting incidents. If the link between recognition and safe behavior is overly strong, the unwillingness to be connected to situations where presumably unsafe behavior is involved will increase. In other words, this could create a climate where there is a risk of 'killing the messenger' (Krause 2005: 136). This is an extremely undesirable situation since effective safety leadership is depending on reporting of incidents.

The same authors who voice this warning also claim that it is important to recognize safe behavior by recognizing individual employees who contribute to safety. But their point is to differentiate between safe behavior connected to a low frequency of incidents and constructive safety efforts, and promote the latter (Roughton and Mercurio 2002: 209-210).

[6]This area is linked to the opposite dynamic, namely holding people accountable for unsafe behavior. This issue will be addressed elsewhere.

6.1.6. Employee participation

In relation to the need for communication inside the organization the literature also calls for more active employee participation in safety related activities. As already mentioned, employee feedback channels can integrate their knowledge and experience in the process of increasing safety in an organization. Employee participation increases safety awareness on leadership levels. There are however additional advantages of this approach.

Since employees are directly facing safety hazards on a daily basis they will be motivated to remove potential threats to safety. They also possess expertise on details in the production process and can assist in assessment of how changes in it may affect production. This is essential if safety efforts are to be well-aligned with work carried out (Roughton and Mercurio 2002: 119).

The problem of employees who do not follow safety procedures can be alleviated by getting them involved in efforts to increase safety. Roughton and Mercurio stated that:

"We as humans naturally resist change – but we have a tendency to support ideas that we help to develop and implement." (Ibid: 120)[7]

Employees will believe in that safety can be improved if they will be involved in the process of improving it. Not only because this is a remedy against resistance, but also because it may convince them that their individual behavior can make a difference. Inclusion in decision making processes is also identified as a morale booster and productivity increasing effort on a general level (Ibid: 116-118, Thomen 1991: 360, Krause 2005: 146).

Alston (2003: 12-13) claims that a successful safety culture (safety culture will be addressed below) is depending upon the inclusion of every member of the organization in the safety process. This inclusion should start the same day the new employee begins his/her work in the organization. If done thoroughly enough, the new member will be integrated in the existing safety culture, and contribute to the overall safety of the organization.

[7]Unfortunately Roughton and Mercurio do not elaborate on the sources of the theoretical influences that have given them the perspective to lay down features of human nature, which is a highly debated field in most other academic contexts.

6.1.7. Safety culture

In the current discussion on safety, safety culture is a central concept. Leadership is identified as an important component in the creation of a safety culture. Roughton and Mercurio claim that:

"Management Leadership is the magnet that aligns the driving force for developing a safety culture." (2002: 53)

Although safety culture is a widely recognized concept in the literature on safety, it is also controversial. There is still a common theme from proponents and critics in the sense that leadership is identified as a crucial part for the success of a safety culture, albeit from different theoretical viewpoints. Note however that the literature varies from just mentioning safety culture as an important concept, to describing it as the ultimate goal of safety management. Consequently, the amount of focus attended to the concept varies.

Safety culture as a concept is related to the identification of leadership commitment and values, since these are seen as fundamental for a safety culture. But safety culture is placed at a different analytical level, referring to "… the invisible force behind the tangibles and observables in any organization…" (Rochlin et al. 2004: 48). As mentioned, there is no consensus on the concept of safety culture, but conveniently Weigman et al. (2002) specifies a number of common features of a safety culture. Although Weigman et al. has no specific concern for safety leadership, they list some common features which are central to an understanding of safety leadership; it refers to shared values among the members of an organization, it is closely related to supervisory and management systems, it has an impact on the behavior of members in the organization and it is fairly stable and resistant to change. (Ibid: 6).

These central features are expressed in different ways within the literature on safety leadership. Roughton and Mercurio state that safety culture is more than the sum of the parts of an organization, since it comprises the beliefs, attitudes and behaviors that are shared in it. The tangibles and observables relating to safety culture they identify, concerns certain characteristics which are the result of every employee holding safety as a core value. There is a feeling of responsibility for safety in every worker, every worker is prepared to go beyond the call of duty, and safety-improving behavior is carried out on a routinely basis. In this perspective, the way leadership contributes to a good safety culture, is primarily linked commitment and values. Since safety

culture is the outcome of more than just the activities of leaders, involvement of all the members of the organization is important, as well as good channels to communicate its safety commitment (Roughton & Mercurio 2002: 51-63).

Ruchlin et al. (2004: 48) specifies certain general leadership activities which are central in any effort to provide change in an organization. Leadership needs to align and motivate people as well as establishing direction. Failures in the instilment of a safety culture can typically be traced back to failures or breakdowns in these activities.

Krause (2005) has a different approach to safety culture. He regards it as the outer dimension of an organization, much a result of leadership practices. Therefore leadership needs to stay alert of the effects of their behavior on safety culture. Although intentions may be good, a CEO with a strong focus on profits could contribute to a deterioration of the safety culture. Krause also claims to have identified a number of salient properties in a safety culture which promotes organizational functioning. In his view, organizational culture is the result of front-line workers' perception of these properties. Procedural justice is identified as one of the important aspects of organizational functioning. Leaders should be concerned with how ground staff perceives procedural justice, and act to change the related process it if is perceived as unfair. Other important properties of organizational culture are workgroup relations, organizational support for employee well-being and organizational commitment to safety (Krause 2005: 59-82, Krause & Weekley 2005).

Reason (1999) defines a successful safety as an informed culture. The first of four main characteristics of such a culture is that it is a reporting culture, i.e. a culture where reporting on safety-related matters is considered of importance to the organization and as an integrated part of the duties of employees. This is in turn depending on the next characteristic, which is that it is a just culture.[8] This means that the organization is fair in its treatments of those who unwillingly commit actions with safety consequences, that it does not punish individual employees for committing errors produced by the systematic properties of the organization. The third characteristic is that of a flexible culture, which refers to the ability to manage complex and difficult situations. One particular aspect of this is that the organization should not only rely on traditional hierarchies to manage this type of situations. The last characteristic is that the safety culture should also be a learning culture; one

[8] A more detailed description on 'just culture' will be provided elsewhere.

that demonstrates a willingness to learn from minor safety-related events as well as from incidents and accidents.

As mentioned, safety culture is not a coherent concept. Two main features in the literature are that a safety culture involves all of the members in an organization and stress that leaders need to be aware of unintended effects of their behavior. Consequently, leaders who wish to promote a safety culture need to develop and involve all employees in this work and consider the effects of all aspects of leadership behavior.

6.1.8. Responsibility & accountability

Responsibility and accountability are closely intertwined. Generally safety responsibilities are expected to be clearly assigned to possible to assign accountability. Accountability is a subject that gets a lot of attention in the literature and there seems to be consensus on how to deal with unsafe behaviour. Although associating the reporting of unsafe behaviour with some kind of punishment is seen as potentially dangerous and problematic, it is still regarded as necessary to uphold order and to avoid an environment of laissez-faire.

But there are voices of dissent even in this area. Krause (2005: 143-144) sees the punishment of those who are involved in events where safety is compromised (and this is reported) as totally unproductive. Since safety leadership is depending on access to information on safety related matters it can be counterproductive to punish those who provide such information. Although the placing of blame might be a tempting and simple way of dealing with the potentially dangerous behavior of individuals, it will stop the organization from learning and considering the more systematic aspects that cause this behavior.

The majority of authors do however seem to believe that accountability needs to be upheld. None of them argues that it is unproblematic for an organization to rely on punishment of unsafe behavior. Nevertheless, a strong correlation between an organization holding people accountable for their actions and an adherence to safety regulations is widely recognized. As Alston (2003) puts it:

“Allowing a free pass for a willful wrongdoing encourages others to expect similar tolerance-promoting an unsafe environment.” (Alston 2003: 8)

To accept "willful wrongdoing" might be the start of acceptance of continuously dangerous behavior. Even though organizations should avoid immediately placing blame on someone who has made mistake, recurrent behavior of this kind needs to be disciplined. This means that there is a need to hold people accountable for their actions. Thomen (1991) provides a step-by-step procedure where he describes the degree of understanding the organization should show to 'unacceptable employee safety behavior'; starting with informal contacts with the individual, gradually increasing the severity of the disciplinary action, and if nothing else helps, finally termination of the employment. If 'gross misbehavior' is found during safety auditing, the worker should even be removed immediately (Thomen 1991: 208). Other authors propose other disciplinary actions, such as fines and pay-reduction. But in the literature the problem of knowing when a person should be held accountable or not, since it is only necessary when the dangerous behavior is intentional, is also discussed. McSween (2003: 16-17) states that every member of an organization is responsible of knowing the safety rules and regulations, just as citizens in a society is responsible of being aware of all the laws.

Alston (2003: 9-10) argues along the same lines and presents statistics showing that human error is responsible for up to 90 percent of all accidents in a number of domains. He goes on to say that there are a number of human errors that should not be characterized as blameworthy, since they may be the result of factors outside of the control of the individual. But in the end he maintains that there are numerous situations where negligence, complacency and willful wrongdoing must be seen as the root-cause of the accident (Alston 2003: 9-10)

The discussion of accountability is also set in relation to safety culture. Reason (1999) argues that a just culture is a critical part of a successful safety culture. Consequently, a 'no blame culture' is not the desired goal, since it does not draw the line between acceptable and unacceptable behavior. Reason refers to research which has identified up to 10 percent of unsafe acts as blameworthy. However, an organization that emphasizes punishment has to accept a possible deteriorated willingness to report. In the end this means a majority of actions should be accepted as non-blameworthy and employees should be able to report them without fear of disciplinary actions. A just culture is defined by the rewarding of employees who contribute with safety-related information, including on their own mistakes, but there should also be a clear distinction between acceptable and unacceptable behavior. To achieve this clear line, common principles for how the judgment of actions is carried out needs to be in place. Reason

suggests that the line should be drawn between negligence, which could be handled within the organizational safety process, and recreational substance abuse or malevolent damage. In his perspective, unacceptable behavior is handled outside the organization by laws, while other human errors are handled inside the organization (Reason 1999, GAIN 2004: 4-7).

Even though accountability is a debated subject the recurring theme is that blaming people is problematic, but organizations should still establish some sort of line between acceptable and unacceptable behavior to be able to hold people accountable.

6.1.9. Behavior-based safety process

An approach that can guide strategies for safety is the "behavior-based safety process", which basically means that safety efforts should be oriented towards the behavior of members of the organization. Authors on safety leadership, who disagree with having strong focus on behavioral aspects of safety management, still relate to this approach, which makes it an interesting junction in the literature.

The starting point of the behavior-based safety process is the belief that the most efficient way of influencing safety is to change the behavior of the employees. Krause (2005: 85-101) presents this from the psychological perspective of behaviorism. This perspective is based on the idea that behavior has two determinants, antecedents and consequences. Antecedents are what precede behavior and consequences are what follow behavior. In Krause's view, consequences are a much more determining factor on behavior and thus shall safety efforts be oriented towards consequences, which preferably should take the form of positive feedback on safe behavior. Roughton and Mercurio (2002: 310-343) agree with this perspective. Although they try to combine it with other measures their main argument is that leaders can contribute to organizational safety through positive reinforcement of safe behavior.

Perhaps oddly, Krause, this time in combination with Weekley, argues in a later article that safety leadership should widen their focus to other aspects, and avoid focusing too much on behavior based efforts. Instead the role of leadership style is brought forward as the distinction between success and failure in safety efforts (Krause & Weekley 2005).

6.1.10. Safety Assessment

One central aspect of efforts to promote and manage safety in the literature is that of having systems to assess and audit the safety of an organization. In the literature there is some disagreement on if it is preferable to use assessment or audits. McSween (2003) differentiates between the two by defining audits as being concerned with compliance to rules and regulations and assessments as concerned with the whole safety process in the organization. Generally, a safety assessment is a systematic approach to examine the safety efforts performed in an organization. The recommendations on how to conduct safety assessments are sometimes very specific in the literature, but here we will remain on a general level.

A safety assessment should start with an understanding of safety as being governed by laws and regulations. This is identified as a good starting point since it is necessary as a framework for understanding safety. Another aspect is that of credibility. Since it is crucial to have the support of the employees to be able to increase safety an assessment needs to identify how work is actually performed. So the actual safety assessment is the comparison of safety as regulated and safety as actually performed in the organization. In the literature there are no general success-formulas on how to carry out these assessments. There are however recurring suggestions: Getting employees involved in the safety improvement process serves several purposes. It increases the credibility of the process, but perhaps more importantly; it provides the assessment with the data needed for a good understanding of the safety in the organization. Such data can be collected in with any suitable method; from just asking questions to more explicit ideas on survey and interview methods. Rougthon & Mercurio (2002: 347-377) propose a combination of assessments: One carried out by management of the organization, another carried out by an independent reviewer (e.g. an external consultant), combined with perception surveys to analyze cultural aspects of safety.

Thomen (1991) has a different perspective referring to safety audits. Since the overall goal of safety audits is to improve the safety-related behavior of the employees, the strategies on how to successfully communicate desired behavior to the employees needs to be considered. This communication is in itself problematic since it reinforces a top-down perspective, with leaders telling employees how to do their job. Defensive reactions and resistance can be expected if this communication is not calibrated to how work is performed in the organization. To adopt a reinforcing attitude that recognize the good things employees are doing, combined with questions which can

encourage them to consider areas of safety where attention and improvement is needed, might be the best strategy (Thomen 1991: 197-217)

The last stage in the safety assessment process is to present and implement the results. The literature suggests that identified problems should be presented together with explicit strategies for the implementation of changes needed to address these problems. A first step is to identify the gaps between the results of the assessment and the research recommendations for a particular problem area. This can be followed by a step-by-step implementation plan. The implementation team should consist of members from different levels of the organization, as employee participation is vital also here. Another recommendation for the setup of an implementation team is that individual responsibilities regarding monitoring of the implementation-process should be assigned to ensure all propositions from the assessment will be properly managed (McSween 2003: 33-50, Roughton & Mercurio 2002: 347-378).

6.2. Theoretical contextualization

The previous section consisted of a literature review on the concept of safety leadership. As mentioned initially in this report, one of our aims is to identify the problems with the approach to safety leadership in current accounts of it. In order to do so a summary of the development within philosophy, leadership theory and safety theory will be outlined in this chapter. This will provide the analytical tools which can be used to explain the deficiencies of previous conceptualizations of safety leadership.

6.2.1. Science, objectivity and constructivism

The notion that science produces objective knowledge has been central in the development of modern society. However, developments in the past decades within humanities and the social sciences have challenged this idea. Several different theoretical paradigms have convincingly criticized the idea that there is a way of establishing universal truth. For example within sociology, interpretative traditions have colonized more and more fields, adding subjective components to knowledge-production. Within philosophical traditions such as post structuralism, postmodernism and science studies cornerstones of traditional ideas on science have been dismantled.

The French philosopher Michel Foucault describes the contemporary view on knowledge as ‘the modern episteme’. This episteme or paradigm is what

structures our outlook on the world, specifically on what is regarded as scientific discourse in a specific historical and social setting. It has conditioned scientific discourse with a belief in universal objective knowledge. In addition, it encompasses a conception of the individual, and a certain way of perceiving human activity in the world. A dichotomy of knowing or not knowing is part of this, where the discursive distribution of responsibility and accountability is a central part; the idea that human action could be characterized as responsible or not, is a result of a perception of the subject as being knowing or not knowing, and consequently, its action should be accounted thereafter (Foucault 2001). Central to this is a narrative of rationality, where human capability to achieve knowledge and use it rationally is taken for granted. The idea that the individual is basically a rational being, commonly referred to as the 'Cartesian subject' (Hall 1992: 274ff), has traditionally permeated the scientific discourse, including perspectives that deals with safety. As a part of this, understanding of safety has been focused on seemingly objective aspects of reality in order to understand failure. Feldman (2004) provides a critical perspective on this, in his description of NASA's 'culture of objectivity'. In a 'perspective from nowhere', i.e. from a knowledge which is of no perspective but its own objectiveness, an emphasis on quantifiable data has gradually grown stronger. Still today, there is a tendency to hold data which could be regarded as objective and independent of the subjective mind as more scientific than other data. Even the very definition of science depended upon a concept of objectiveness. A part of this objectiveness is the belief in universal knowledge, i.e. knowledge that is valid in all times and places.

The paradigmatic shift within humanities and the social sciences during the last decades could be characterized as a decentering of the subject, and a relativization of truth, where the understanding of the individual has moved away from focus on individual rationality to social and cultural levels. Instead of explaining human behavior as more or less rational, the focus has turned to the context as the explanation. The same goes for poststructuralist and postmodern accounts of scientific narratives, where the metanarrative of rationality has tumbled, opening up for multitudes of accounts on reality (Lyotard 1993), and where the idea that we could establish knowledge of something as universally true, has become increasingly problematic.

A contemporary development of these critical accounts on traditional ideas of scientific discourse is that of social constructivism. The idea that objective reality is something outside of human consciousness and can be reached through observation is challenged by social constructivism. The main argument for this is that 'reality' is socially constructed, and by being

reproduced socially, is experienced as an objective reality, exceeding any subjective perspective. In this way, reality is not static, but a dynamic process that is constantly under production and reproduction through social interaction. This does not mean that the socially constructed reality is something random and fluid, since any socially constructed reality also has the possibility of achieving certain continuity. When people interact, and their perception of reality is affirmed by other people, it tends to be experienced as an objective reality. The social reality we experience as individuals is not restricted to the inner world governed by our personal life, but through socialization we experience that our perceptions of reality are inter-subjective with other people and therefore experienced as objective. This 'objective' reality is reinforced through traditions, norms and institutions, which also contribute to make a social reality stable, and consequently making it exceed the individual subjects (Berger & Luckmann 2003). In the tradition of post structuralism, social constructivists argue that language is central in the social construction of reality. It is through language that reality gets constructed in a certain way, and it is through language we construct meaning out of our interpretation of reality. Adding power to it, language constructs certain versions of truth and excludes others. But other aspects of reality are considered active in this construction, such as the material world, which conditions the way humans interpret reality, although in subjective ways (Pinch & Bijker 1987). But the common theme is that there is a subjective component in reality, which makes it difficult to talk about an objective reality (Sjöstrand et al. 2001: 33-36). Instead knowledge is produced through social processes and through social interaction we validate this knowledge. This means that our identities as well as our perception of the world are historically and culturally conditioned, in the sense that there is no essence in how we perceive ourselves or the world (Winther Jorgensen & Phillips 2000: 11-12).

This critique is also aimed at another cornerstone of conventional conceptions of science, namely that of essentialism. Essentialism refers to the view that there in any specific entity can be established a knowledge of certain characteristics which are necessary in order for the entity to have a certain identity. Essentialism has been frequently prevalent in leadership, as in the discussions on certain characteristics needed in a leader. Social constructivism challenge this notion, and claims that our understanding of the world is historically and culturally contingent, and thus that it is not possible to claim that a leader should have specified characteristics in order to be a universally good leader.

To summarize, the philosophical development has moved to a critique and problematization of universalism, essentialism and rationalism. Increasing focus has been moved to how our conception of reality is continually changing and how it is in socially constructed. These philosophical viewpoints will serve as a basis for our conceptualization of safety leadership, both its theoretical and empirical parts.

6.2.2. Leadership theory

To understand safety leadership, the concept of leadership in itself central, since conceptualization of safety leadership also out of necessity will include a theoretical concept of leadership. The history of theoretical ideas on leadership during the 20th century has been rich. A few of the influential perspectives on leadership will be summarized and connected to a general understanding of leadership that follows the theoretical paradigm proposed. Leadership theory has of course not developed isolated from philosophy and many of the themes in the philosophical development described above can also be found in leadership theory.

But first of all, what is leadership? A definition that provides a starting point to grasp the concept in its most general sense is provided by House:

> "the ability of an individual to influence, motivate, and enable others to contribute toward the effectiveness and success of the organizations of which they are members" (House 2004: 15).

This might appear unproblematic, although the question how to reach this objective appears to need further consideration. The theoretical debate on this during the 20th century has been intense and varied and this chapter will summarize a few aspects of this debate. Theory will also be analyzed from a safety leadership perspective in order to extract learning points from this debate as well as from the philosophical framework proposed.

The good leader

The most immediate concept of effective leadership regards it as an inherent property of an individual. The leader's personality alone would convince followers to his greatness in leading. In the history of ideas, Weber is often mentioned as someone who conceptualized this phenomenon. He defines the

good leader as in possession of certain qualities, which would empower him to a position from where loyalty and obedience of the followers is more likely (Kendall et al. 2000). In history, it seems as though it is not hard to find examples of such leaders (e.g. Roosevelt, Churchill). This is however a problematic way of defining a good leader. The idea, influenced by trait theory, that certain characteristics in a person would enable him/her to be a good leader, might seem intuitive. But the problem lies in identifying these traits. One could argue that Hitler had some personal characteristics that made him a 'good' leader in Germany during the 1930s, but it is highly questionable if the same traits would make a good leader in contemporary Sweden. This is a good example of a theory permeated with essentialism. Just as in the tradition of social constructivism, criticism towards the universalistic ambitions in defining certain traits that would always characterize a good leader has been formulated against this perspective. But there are other theories on leadership which acknowledge the problems of essential traits when the context changes.

Scientific management

F. W. Taylor's ideas on how to develop successful leadership recognized the fact that leaders have to adapt to the context where their leadership is to be performed. Scientific management introduced theories on how leadership should organize companies to achieve the highest possible productivity (Taylor 1920). This theory differs in some way from more general theories of leadership, since it settles on a very specific goal for an organization. It's nevertheless interesting, since it is still a theory based on essentialism. It is based on that there is one best way of organizing production, since the context, in this case factory-workers, requires this best way to reach its' ultimate efficiency. Consequently, this theory is hosting the same fallacy as the good leader-approach. Even though it is possible to appreciate the idea that leadership has to adapt to the context, we still end up with an essentialist account, and it remains problematic to define exactly how this good leadership shall adapt to the given context and Taylor's account of efficiency would probably not attract many supporters in contemporary western worker unions.

Contingency theory

The contingency approach is another influential theoretical paradigm within leadership theory. It differs from scientific management in the sense that it recognizes the changing nature of effective leadership in changing contexts.

F. E. Fiedler's contingency model argues that no specific type of leadership can be effective in all possible situations, because when situations change so does the requirement for the appropriate leadership style (Fiedler 1967). The contingency approach identified the problems in finding the one good leadership, moved leadership theory away from the focus on specific personalities and traits and focused more on the multiplicity of good leadership given the contingencies of the context. Unfortunately, this perspective cannot avoid the trap of taking the ability to establish the nature of an essentialist leadership and context for granted. Even if the idea that changing conditions affect which kind of leadership that will be successful the problem to define exactly how this leadership is constituted, as well as defining what kind of situation requires a certain type of leadership, remains.

Situational leadership

The situational leadership approach is not similar to the contingency approach. It stresses the fact that a leader has to be dynamic in the sense that he/she need to adapt to a changing context. It differs from the contingency approach since it believes that the same type of leadership can be good in different situations, just as long as it remains sensitive to the changing nature of the situation. More concretely, the situational approach argues that the leadership has to realize the nature of their follower (e.g. the workers at a factory) and calibrate their leadership to this (Grint 1995: 141). So is this the answer to the
problems of the preceding approaches? Well, even situational leadership has an essentialist component to it, since it assumes that leaders have the ability to constantly be aware of the changing context around them. But how does a leader learn about the nature of his/her followers?

Transformational leadership

A highly influential theory on leadership is that of transformational leadership. As mentioned earlier in the text, transformational leadership is formulated in contrast to transactional leadership. Transactional leadership is based on simple reward-punishment logic in leading; reward desired behavior and punish undesired behavior. Transformational leadership on the other hand wants to lead individuals through satisfaction of interest beyond mere self-interest. This is achieved through a style which makes the followers identify their own needs with those of the leader. This transformation takes place through the four dimensions of transformational leadership:

Charismatic influence: Through role-model behavior the leader causes the followers to identify with the leader. This is typically achieved through a set of values that is demonstrated through conviction and credibility.

Inspirational motivation: Refers to the skill of communicating a vision that inspires the followers to follow him. This can be achieved through setting goals and providing meaningful tasks to achieve these goals.

Intellectual stimulation: The ability to encourage followers to be creative and stimulate people to develop their ideas.

Individualized attention: Being able to pay enough attention to each individual and coach/mentor the individual, as well as listen to his/her needs.

This leadership theory also follows the tradition of conventional scientific discourse, in its universalistic ambitions. By assuming that certain actions will have certain consequences in people, is also an essentialist account, since it entails a notion of a universal human nature.

Constitutive leadership

Although these theories may seem to be different in many aspects, they all share the characteristic of a claim of knowledge in how to establish the best leadership. From a constructivist and anti-essentialist perspective this is highly problematic, since its ambition is to look at the specifics of a historical and social setting and move away from universalism. Arguing that certain traits, abilities or activities constitute the best possible leadership, disregards the fact that contextual developments reconstruct our reality. What was considered good leadership yesterday or in a certain environment might not be so today or in another environment. Sociologist Keith Grint has provided a useful graph of some of the theories and also introduced a new perspective, which is more up-to-date with the shifts in social and human sciences (Grint 2000:2-3).

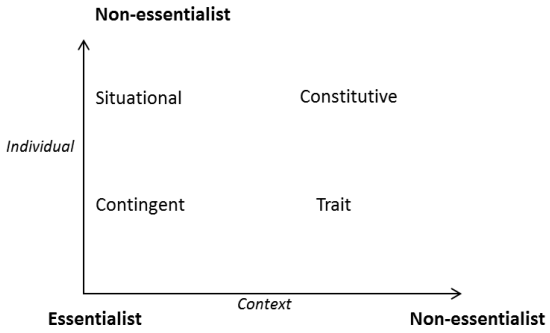

Figure 1. Leadership theories according to their essentialist properties (Grint, 2000).

Some of the different perspectives summarized are positioned in this scheme according to where their essentialist property belongs. They all seem to be falling in to the trap of assuming objective knowledge of either how the best individual (or group) should be characterized, or how the nature of the context should best be managed. These are all incongruent with constructivist standpoints, as they assume that knowledge of objective reality is possible (and comprise underlying essentialist, rationalistic and/or universalistic assumptions). Social constructivism points to the social production of reality, and the impossibility of objective knowledge. But Grint also introduces a different approach, which he calls the constitutive approach. This remains non-essentialist to both leadership and context.

Constitutive leadership

The idea of constitutive leadership is straightforward. If a success story of an organization can be causally explained by their leaders, then the assumption that their actions produced the success will be strengthened. But this idea neglects the fact that it also requires certain actions by the followers. If the followers were not to treat the leadership as leaders, there would not be much leadership to consider as reason for success. Consequently, the efficiency of leadership is a result of a social interaction, where the actions of both leaders and followers must be considered (Grint 1995: 150-161). But the idea of leadership as a social interaction also implies that there is nothing static about it. Instead it has to be constantly reproduced by the actors involved, in order to continue to exist. This view is adopted from social constructivism, and basically says that the social reality, which leadership-followers are a part of, is continuously reproduced by people. If people did

not interpret a situation in a particular way, and acted accordingly, they wouldn't be part of the reproduction of this particular social reality. For example, if the people of a certain country did not interpret the government as their legitimate leadership, and did nothing to act as the followers of them, there would be no government leadership, no matter how many fancy government buildings and constitutional powers the government was in possession of. So is leadership just a random and fluid quality which appears anywhere and disappears just as suddenly? Certainly not and this is obvious if we look at reality. There are lots of stable leadership-followers situations. The challenge, from the perspective of leaders, is to be convincing enough to persuade the followers to be a part of the reproduction of the leadership-follower relation.

The performance of this is commonly referred to as the execution of power. Power is a complex concept (enough to require a report on its own), but here the fact that power is an essential part of any relation, and certainly a relation of leadership-followers, will be highlighted. This means that the social construction of reality has to be understood in a wide historical context. Surely, in a specific historical and social setting, we can observe certain leadership styles that seem to be more successful than others, but it is problematic to extrapolate this into objective knowledge. As a historical and social setting develops and change, this style might be less successful. Here we also find the major fault in other leadership theories. If the relation between leaders and followers is socially constructed and reproduced, it is pointless to talk about objective knowledge on the most effective leadership. It will always be structured by the socially constructed reality we are a part of. Therefore good leadership is not a property one could be in possession of (essentialism), but should more be looked at as a social relation. Successful leadership is a successful relation between leaders and followers. But this perspective also entails the constitutive nature of leadership in the sense that leadership is active in the construction of reality.

Leadership as discourse

An analysis of safety leadership from a theoretical perspective that considers leadership as constitutive and reality as socially constructed is concerned with the discourse of safety. A discourse analysis has the philosophical and theoretical assumptions of social constructivism as its foundation. Consequently, it does not regard language as a mirror of objective reality, but instead regards language as the mediator in our understanding and construction of reality. Since social reality is reproduced through language, it

is structured by already existing discourses. Discourses refer to the systems of meaning which make up a certain social reality. In an organization this could be the truths about safety, working conditions and procedures. When we act in this social reality our language either reproduce or change this reality, through discursive practices such as conversations, written policies or the social interpretation of the material context. If we want to understand how reality is constructed we need to analyze how we speak about it, or rather how we use language in our representations of reality (Winther Jorgensen & Phillips 2000: 15-18). As language is the tool as well as the barrier to reality, it is also the focus of our analysis. It is the tool - because without it the world would be meaningless, it is also the barrier - because we cannot reach the world directly (Grint 1997: 138-139).

When applying discourse on concepts of leadership, our interest would be how leadership as a discourse is constructing safety in organizations. An understanding of safety leadership in should then be an analysis of the safety discourse.

Safety theory

When trying to understand safety and risk different models of how accidents happen, with different theoretical implications, can be used. Traditionally, focus on human error has been a prevalent mode of analysis. Coming across the cause of the accident at the spot where human failure has interfered with organizational and technological rationality, has been the objective of accident investigation (Woods 1999, Hollnagel & Woods 2006b: 1). In a rational world, with rational individuals, capable of perfect knowledge, what else than human negligence could cause the rational process to fail? Research within the field of human factors and accident analysis has shown us that this perspective is far from satisfactory and obscures the complete picture of the process that leads up to an accident.

Following the theoretical shifts in the human sciences, ‘the new view of human error’ argues that human error has to be put in a systemic context. This means that if we intend to understand the whole process that leads up to a failure, such as an accident, we have to understand what influenced the individual to act in a way that at a first glance seems to be the cause of the accident (Dekker 2002: 61ff.). The old, rationalistic view reduces a complex phenomenon that has a lot more sources than just the erratic behavior of humans, to finding the culprit who has erred. The perspective offered by the new view on human behavior in organizations entails a systemic perspective

on safety. It recognizes the impossibility of separating human behavior from its context, and therefore regards safety as a systemic phenomenon. It differs from other accident models, such as the sequential model or the epidemiological model, since it considers safety as an emergent property of the system, and safety failure as consequence of the same properties. Socio-technical systems in action, such as operation of a nuclear power plant or an aircraft, are too complex to reduce to single components and understanding of safety has to focus on the performance of the whole system. Due to the complex nature of these systems, the way to avoid accidents is to monitor the system and learn in which situations the systems start to drift towards failure and have tools and abilities to resolve these situations (Hollnagel 2002).[9]

6.3. Discussion of the safety leadership literature

The next step in this coda is to discuss the literature to try to identify aspects which are missing or problematic and to provide a critical account of it. This discussion will be focused on certain areas which have been considered as problematic based on general concerns as well as on the theoretical contextualization of them.

6.3.1. Critical observations

An initial critical remark on the current state of safety leadership in the literature is its leaning towards rationalistic accounts of leadership. This remark is valid at a general level since rationalism permeates the entire discourse of safety leadership. The recommendations regarding safety leadership found in the literature assumes that safety is a quality which can be simply identified, measured and improved by certain leadership activities. Such a view entails an indeed simplistic idea of safety, and while perhaps captivating, of little value for organizations working with complex socio-technical systems such as nuclear power plants. This does not in any way mean that everything presented in the literature is wrong or of no meaning in an organization that is trying to stay safe. But the rationalistic and simplistic leaning of theories of safety leadership is problematic and a strong indicator of the need for further development of the theoretical framework for it. The challenge of increasing safety lies in the fact that safety is an outcome of the ability to cope with what is uncertain. This perspective is completely lacking in the literature. The prevalent assumption that failure is the outcome of

[9] A more thorough account on systemic perspectives on safety has been provided elsewhere in the report.

substandard or bad behavior which simply needs to be disciplined and improved is very inadequate. The rationalistic leaning is also combined with essentialist and universalistic ideas on the best safety leadership that is supposed to be achieved in one or another way.

The focus on "values"

One example of essentialism and universalism is the focus on values. Safety is claimed to be partly depending upon the formulation and communication of safety oriented values by leaders. Typically these would be values that prioritize safety above production efficiency. The problem with emphasizing this is not that it is wrong to have such values, but rather that it is simplistic and trivial, which perhaps is part of its intriguing nature. The absence of formulation and communication of values that prioritize safety could be a part of organizational safety problems and so could ineffective communication or undermining of values by the actions of leaders. Of course there is sense in formulating, communicating and acting along values of safety, but the challenge of a safety leader is not met by this alone. The problem does not lie in formulating these values, but rather in being aware of when safety priorities are eroded to the benefit of other priorities, such as production efficiency. In this sense the focus on value-formulations is part of a rationalistic discourse. The main challenge is identified as the explicit formulation of values and then convincing (or disciplining) the employees into following them. The effect on safety is taken for granted.

Top-down leadership

Another aspect of the literature's views on safety leadership is its strong focus on top down leadership. This is seen in the substantive concern for leadership visions and goals. Identifying specific and strong formulations of visions and goals of the organization as one of the main aspects of a good safety leadership is a sign of top-down perspective. The followers need to be informed of what to do in order to be safe. The problem for complex and competent organizations is rather that safety leaders need to ensure conditions for followers to use their professionalism to stay safe. The well-dressed but clearly visible underlying assumption that leaders need to set their employees straight so they start acting safe is based on a 'the leader knows best' attitude of little value for complex and competent socio-technological organizations. This is part of an essentialist and individualist discourse, since it assumes that positive change is achieved through leadership knowledge of the best way to do things, and change is caused by

certain characteristics and traits of individuals. As was briefly discussed on constitutive leadership, this is a one-sided view on the effects of leadership, since it neglects the role of employees in the construction of leadership.

The assumption that effectiveness of leadership is determined by the style of leadership, and that 'research' has shown that a certain leadership style is the best to use, is also part of a rationalistic, essentialist and universalistic discourse. Not only is this problematic because the research that referred to in all statements on 'best leadership style' is always contested by other research. This perspective is also problematic in its universalistic claims; in the assertion that there is a 'best leadership'. This implies knowledge of the truth of leadership, as well as that this truth can be universally applicable. Any such assumption is problematic since these claims need to be contextualized to the specific organizational and social context that they are to be applied in. Furthermore, many of the accounts on safety leadership denote a theoretical alliance with the concept of transformational leadership. Although there may be research that supports that this is an effective leadership style, it is still culturally contingent and must be considered in the existence of different professional and national cultures. Another drawback, which is a problem with any normative theory of leadership which refers to specific qualities of individual leaders, is that they only observe leadership as concentrated in one or a few individuals, denying the importance of overall organizational interaction and a broader perspective on leader-follower interaction. This is problematic in a concept of safety leadership that is up-to-date with latest developments in systems safety.

6.3.2. Safety culture

Safety culture is not as easily criticized in the literature due to the many different perspectives applied on this concept. One problematic aspect of safety culture in regards to safety leadership is the assumption that safety culture can be deconstructed into parts which can be modified by leadership in order to reach a good safety culture. This is perhaps a natural consequence of using culture as the analytical point of focus. While it might be meaningful to speak of an organizational culture, it is also problematic to use it as a point of departure for improvement, since it should be more interesting to see what precedes culture. A claim that a safety issue is a result of a bad safety culture could be justified, but it is difficult to manipulate it. As a consequence of this it is difficult to formulate normative ideas of safety leadership in relation to safety culture, not denying the fact that leaders are important actors in the creation of a safety culture.

Accountability

Yet another highly problematical issue in the literature on safety is that of accountability. Even though it is widely agreed that punishment is problematic as a strategy to influence employee behavior there is still close to a consensus on the fact that there is a need for a demarcation of acceptable and non-acceptable behavior. This is problematic since such a demarcation is arbitrary; there is no obvious or objective way of making it. It is also questionable whether there is actually a need for such a demarcation. In this sense the idea is a part of the rationalistic top-down view; the erratic behavior of employees is regarded as the main source of failure. Research seem to indicate the contrary, i.e. employees are actually the main source of safety and their behavior should be regarded as a systemic output that needs to be changed through the manipulation of the working conditions. In this view no demarcation is needed, since it is philosophically and ethically highly problematic to be speaking of a non-acceptable behavior.

Systems safety

Another problem with the literature on safety leadership is that it is not up-to-date with research on systems safety. It is highly focused on behavior based safety processes and neglects the view that safety is an emergent property of a system. By only focusing on behavior as the source of safety, the influence from other components and the couplings between them are disregarded. This makes the approach quite questionable for highly complex organizations, since an isolation of behavior and assumption that an emergent property as safety can be improved through the modification of one isolated factor is not supported by research on systems safety.

These are a few areas in the literature that have been identified as problematic and needs to be addressed in a renewed conceptualization of safety leadership. Summarizing, previous accounts on safety leadership are all permeated by the discourse of conventional science approaches, namely those of rationality, universalism and essentialism. The critical remarks are not intended to claim that previous theories and conceptualizations are of no use for safety leadership in general. But as explained in the main report, when applied to the philosophical and theoretical context we are proposing, there are a number of fundamental problems with these accounts that make them of little value complex and competent organizations such as those within the nuclear industry. By sketching a way out of the dependence upon

a narrative of rationality, universalism and essentialism our aim has been to provide a new understanding of the complex and intricate balance between safety and production efficiency.

7. References

Alston, Gregory (2003) How safe is safe enough? - leadership, safety, and risk management (Aldershot: Ashgate)

Amalberti, R. (2001). The paradoxes of almost totally safe transportation systems. Safety Science, 37, 109-126.

Berger, Peter L. & Luckmann, Thomas (1998) Kunskapssociologi : hur individen uppfattar och formar sin sociala verklighet (Stockholm: Wahlström & Widstrand)

Capra, F. (2002). The hidden connections. New York: Doubleday.

Cheru, Fantu (2002) African Renaissance – Roadmaps to the Challenge of Globalization (London: Zed Books)

Columbia Accident Investigation Board (2003). Report Volume 1, August 2003. Washington, D.C.: Government Printing Office.

Dekker, Sidney (2002) The Field Guide to Human Error Investigation (Aldershot: Ashgate)

Dekker, Sidney (2006) "Resilience Engineering: Chronicling the Emergence of Confused Consensus" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate)

Dekker, S. W. A. (2004). Why we need new accident models. Journal of Human Factors and Aerospace Safety, 4(1), 1-18.

Feldman, Steven P. (2004) "The Culture of Objectivity: Quantification, uncertainty, and the evaluation of risk at NASA" in Human Relations (London: Sage Publications) Volume 57(6): 691–718

Fiedler, Fred E. (1967) A Theory of Leadership Effectiveness (New York: McGraw-Hill Book Company)

Fleming, Mark (1999) Effective supervisory safety leadership behaviors in the offshore oil and gas industry (Offshore Technology Report 1999/065, Health and Safety Executive)

Foucault, Michel (2001) The Order of Things: An Archaeology of the Human Sciences (London: Routledge)

GAIN Working Group E (2004) A Roadmap to A Just Culture: Enhancing the Safety Environment (Flight Ops/ATC Ops Safety Information Sharing)

Gras, A., Moricot, C., Poirot-Delpech, S. L., & Scardigli, V. (1994). Faced with automation: The pilot, the controller, and the engineer (translated by J. Lundsten). Paris: Publications de la Sorbonne.

Grint, Keith (1995) Management – A Sociological Introduction (Cambridge: Polity Press)

Grint, Keith (1997) Fuzzy Management – Contemporary Ideas and Practices at Work (Oxford: Oxford University Press)

Grint, Keith (2000) The Arts of Leadership (Oxford: Oxford University Press)

Hall, Stuart (1992) "The Questions of Cultural Identity" in Hall Stuart, Held David & McGrew Tony (eds.) Modernity and its Futures (Cambridge: Polity Press)

Händelseanalys och Riskanalys – Handbok för patientsäkerhetsarbete (2005)

Hollnagel, Erik & Woods, David D. (2006a) "Epilogue: Resilience Engineering Precepts" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate)

Hollnagel, Erik & Woods, David D. (2006b) "Prologue: Resilience Engineering Concepts" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate)

Hollnagel, Erik (2002) Understanding Accidents – From Root Causes to Performance Variability (CSELAB, Department of Computer and Information Science, University of Linköping, Sweden)

Hollnagel, Erik (2004) Barriers and accident prevention (Burlington: Ashgate)

Hollnagel, E., Woods, D. D., & Leveson, N. G. (1996). Resilience engineering: Concepts and precepts. Aldershot, UK: Ashgate Publishing Co.

House, Robert J. (2004) Culture, Leadership, and Organizations: The GLOBE Study of 62 Societies (Thousand Oaks, SAGE Publications, 2004)

Kendall, Diana, Murray Jane Lothian & Linden Rick (2000) Sociology in our time (Scarborough, On: Nelson)

Killimett, Patrick (2006) "Organizational Factors That Influence Safety" in Process Safety Progress, Vol.25, No.2, p. 94-97

Krause, Thomas R. & Hidley, John (2004) "The Credible Safety Leader " in Perspectives in Behavioral Performance Improvement ,March/April 2004

Krause, Thomas R. & Weekley, Thomas (2005) "Safety Leadership – A four factor model for establishing a high-functioning organization" in Professional Safety, Nov 2005, 50, 11: BI/INFORM Global p. 34

Krause, Thomas R. (2005) Leading With Safety (Hoboken: Wiley)

Leveson, N. (2002). A new approach to system safety engineering. Cambridge, MA: Aeronautics and Astronautics, Massachusetts Institute of Technology.

Lyotard, Jean Francois (1993) The postmodern condition: a report of knowledge (Minneapolis: University of Minnesota Press)

McDonald, Nick (2006) "Organization Resilience and Industrial Risk" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate)

McSween, Terry E. (2003) Value-based safety process: improving your safety culture with behavior-based safety (New York: Wiley)

Pinch, Trevor J. & Bijker, Wiebe E. (1987) "The Social Construction of Facts and Artifacts: Or how the Sociology of Science and the Sociology of Technology Might Benefit Each Other" in Bijker Wiebe E., Hughes Thomas P. & Pinch Trevor J. (eds.) The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology (Cambridge: MIT Press)

Reason, J. (1997). Managing the risks of organizational accidents. Brookfiewld, NY: Ashgate Publishing Ltd.

Reason, J. T. (1990). Human error. Cambridge, UK: Cambridge University Press.

Rochlin, Gene I. (1999) “Safe Operation as a Social Construct” in Ergonomics, Vol. 42, No. 11, p. 1549-1560

Rochlin, G. I. (1993). Defining high-reliability organizations in practice: A taxonomic prolegomenon. In K. H. Roberts (Ed.), New challenges to understanding organizations. (pp. 11-32). New York, NY: Macmillan.

Rochlin, G. I. (1999). Safe operation as a social construct. Ergonomics, 42, 1549-1560.

Roughton, James E. & Mercurio, James J. (2002) Developing an Effective Safety Culture – A Leadership Approach (Boston: Butterworth-Heinemann)

Ruchlin, Hirsch S., Dubbs, Nicole L., Callahan, Mark A. & Fosina, Michael J (2004) “The Role of Leadership in Instilling a Culture of Safety: Lessons from the Literature“ in Journal of Healthcare Management, Jan/Feb 2004, 49, 1, ABI/INFORM Global p. 47-58

Sagan, Scott D. (2004) “The Problem of Redundancy Problem: Why More Nuclear Security Forces May Produce Less Nuclear Security” in Risk Analysis, Vol. 24, No. 4, p. 935-946

Sjöstrand, Sven-Erik, Sandberg, Jörgen & Tyrstrup, Mats (2001) Invisible management: the social construction of leadership (Mitcham: Thomson Learning)

Snook, S. A. (2000). Friendly fire: The accidental shootdown of US Black Hawks over Northern Iraq. Princeton, NJ: Princeton University Press. Taylor Frederick W. (1920) Rationell Arbetsdelning (Uppsala: Almqvist & Wiksell)

Thomen, James R. (1991) Leadership in Safety Management (New York: John Wiley & Sons Inc.)

Vaughan, D. (1999). The dark side of organizations: Mistake, misconduct, and disaster. Annual Review of Sociology, 25, 271-305.

Wiegmann, Douglas A., Zhang Hui, Thaden Terry L. von, Sharma Gunjan & Mitchell, Alyssa A. (2002) A Synthesis of Safety Culture and Safety Climate Research (Aviation Research Lab, Institute of Aviation, Technical Report ARL-02-3/FAA-02-2)

Winther Jorgensen, Marianne & Phillips, Louise (2000) Diskursanalys som teori och metod (Lund: Studentlitteratur)

Woods, David (2003) Creating Foresight: How Resilience Engineering Can Transform NASA's Approach to Risky Decision Making (Testimony on The Future of NASA for Committee on Commerce, Science and Transportation, John McCain, Chair October 29, 2003)

Woods, David D. & Cook Richard I. (2006) "Incidents – Markers of Resilience or Brittleness" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate).

Woods, David D. (2006) "How to Design a Safety Organization: Test Case for Resilience Engineering" in Hollnagel Erik, Woods David D. & Leveson Nancy (eds.) Resilience Engineering: Concepts and Precepts (Aldershot: Ashgate).

Woods, D. D., Cook, R. I., Johannesen, L., & Sarter, N. B. (1994). Behind human error. Dayton, OH: CSERIAC.

SKI-reports

Inspektion av BKAB:s förutsättningar att vid oklara driftsförhållanden tillämpa generalklausulen och efterleva krav i SKIFS 1998:1 2 kap 2§ sista stycket (Inspektionsrapport 2003-09-26 ref. 6.09-030904)

Inspektion hantering av uppdagade förhållanden v. 49 2004 (Inspektionsrapport 2005-05-26 ref. 9.09-040988)

Värnild Ola (2005) Ekonomistyrning och säkerhet - En utredning om hur ekonomi- och säkerhetsaspekter integreras vid beslutsfattandet vid kärnkraftverken (SKI Rapport 2005:53)

Internet-references

Wikipedia – Article on 2nd World War
http://en.wikipedia.org/wiki/Second_world_war

Presentations

Franzén Ingeborg, 2006-12-07, Bygga strategisk plan för säkrare vård (At Ledningskraft för patientsäkerhet, Jönköping 7th – 8th Dec 2006)

2012:66

The Swedish Radiation Safety Authority has a comprehensive responsibility to ensure that society is safe from the effects of radiation. The Authority works to achieve radiation safety in a number of areas: nuclear power, medical care as well as commercial products and services. The Authority also works to achieve protection from natural radiation and to increase the level of radiation safety internationally.

The Swedish Radiation Safety Authority works proactively and preventively to protect people and the environment from the harmful effects of radiation, now and in the future. The Authority issues regulations and supervises compliance, while also supporting research, providing training and information, and issuing advice. Often, activities involving radiation require licences issued by the Authority. The Swedish Radiation Safety Authority maintains emergency preparedness around the clock with the aim of limiting the aftermath of radiation accidents and the unintentional spreading of radioactive substances. The Authority participates in international co-operation in order to promote radiation safety and finances projects aiming to raise the level of radiation safety in certain Eastern European countries.

The Authority reports to the Ministry of the Environment and has around 270 employees with competencies in the fields of engineering, natural and behavioural sciences, law, economics and communications. We have received quality, environmental and working environment certification.

Strålsäkerhetsmyndigheten
Swedish Radiation Safety Authority

SE-171 16 Stockholm
Solna strandväg 96

Tel: +46 8 799 40 00
Fax: +46 8 799 40 10

E-mail: registrator@ssm.se
Web: stralsakerhetsmyndigheten.se